Changes That Increase Denver's Distribution Facilities—*Steam station and transmission articles for the operating engineer, in addition to other features and regular departments*

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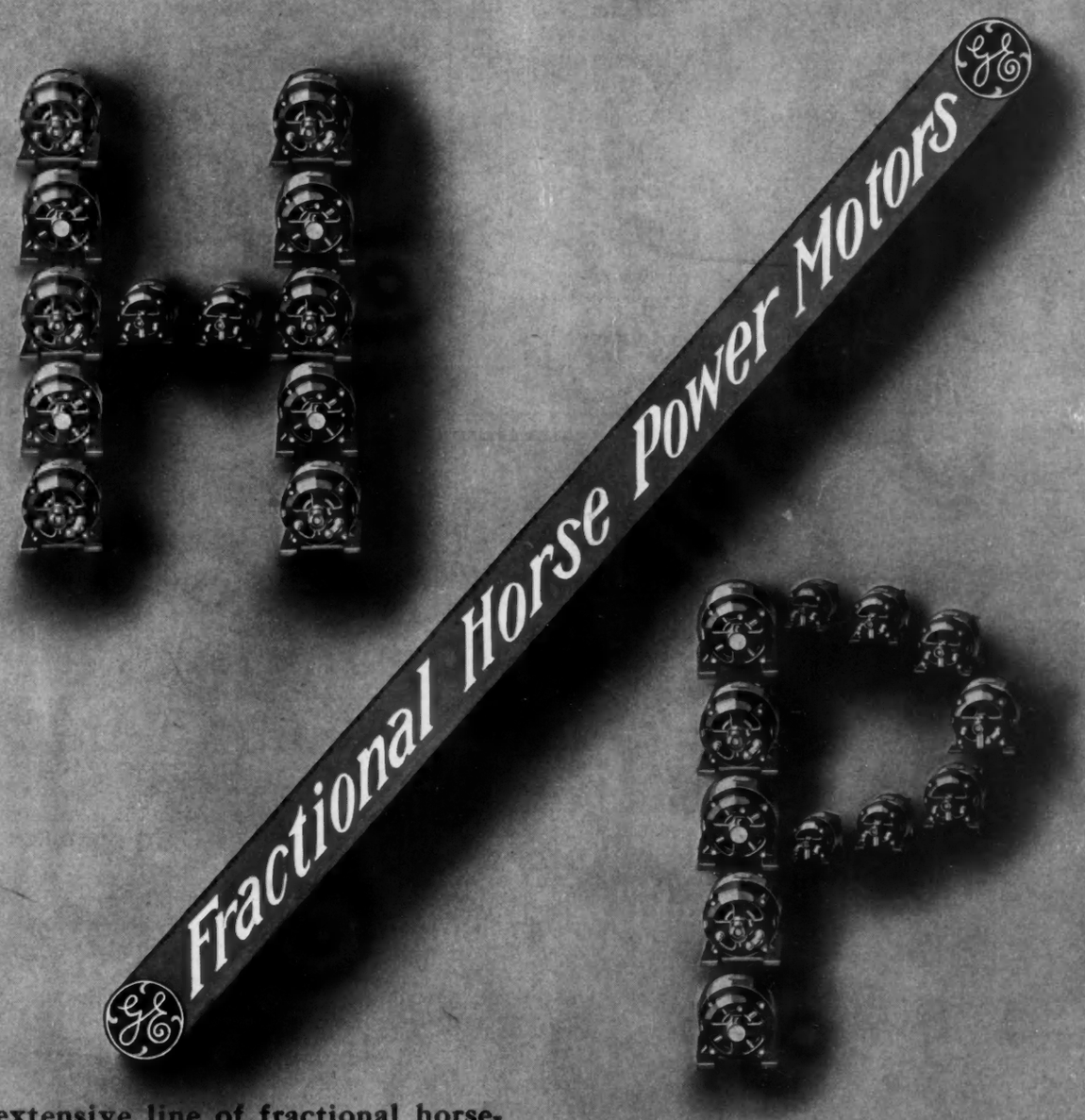

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Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.
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Lighting Our National Monuments

MORE of the monuments which mark significant events in our national life may well be illuminated by night. The lighting of the Statue of Liberty in New York Harbor last week is representative of the possibilities of carrying out a program which lends distinction to such a project. We have all too few such great symbols in our history about which our ideals of Americanism may cluster and which the magic brush of electric light may recreate nightly. There is a patriotic opportunity for the artist and the engineer. Painting great pictures with the sky for a background and electricity for a brush demands an appreciation of the fitness of things which cannot be attained by grouping a few spot lights. In such undertakings an art sense of proportion and final effect must be coupled with the technical knowledge of appliances, of color values, of the reflecting characteristics of surfaces and of the sources of energy available.

While it is evident that the technical illumination features are only a part of a program to light other monuments the part the electrical interests played in the lighting of the Statue of Liberty indicates that they may well take the initiative in other localities. The conception of lighting the Statue of Liberty, for example, was that of an electrical man. It is significant that the electrical energy was most satisfactorily arranged by connecting with the mains of a great central station and that much of the success of the public presentation of the plan which was promoted by the New York *World* has been credited by that enterprising journal to the electrical interests. This example of the possibilities of co-operation should not stand alone.

Valuation Versus Settlement

BETWEEN the two rate cases which have been receiving much attention in Greater New York there are fundamental differences which carry lessons. One case was settled, the other appears to be on the verge of entering into court. One required little time and little money, the other involved a large expenditure of both of these valuable assets. Where consumers of the one company will enjoy reduced rates promptly, the consumers of the other corporation have waited through a long valuation and the presentation of detailed testimony and they now face the possibility of further delay by court proceedings. In the New York Edison Company case no valuation was made, in that of the Edison Electric Illuminating Company of Brooklyn an appraisal of the Public Service Commission took $17,000,000 from the claimed physical value and investment and made no allowance for franchise or going value. The Brooklyn company has a large incentive behind its protest. To see this sum even as a paper deduction is disquieting. If more time and money will lead to a presentation of its evidence which will restore values denied by the commission it can well afford to spend them. If it wins it will gain much. If it loses it will not see its values treated more destructively than in the commission decision. It knows the worst. Is valuation really worth the cost to company, to commission or to public?

A Practical Ground Detector

AS we have frequently remarked, the art of power transmission owes a great deal to the resourcefulness of the engineers on the Pacific Coast. They have systematically pitched in and accomplished things worth doing, often impelled thereto by the necessities peculiar to the widespread networks which they must protect. Mr. Armstrong's report on work with a low-voltage ground detector in this issue is a case in point. The problem was to guard the service on 1200 miles of 2200-volt lines and the solution seems a very practical one inasmuch as it not only shows to the eye the existence of grounds but through a sensitive relay rings a bell which calls attention to incipient trouble. The principle is not unfamiliar, merely connecting three single-phase transformers in *Y*, with a grounded neutral passing through a telegraph relay connected with the bell. Obviously if one phase is grounded the corresponding lamp will go down and the two other phases go up, and simultaneously the alarm bell will sound a warning.

Perhaps the most interesting feature of the ground detector is the arrangement of the lamps. These are in a cylinder divided by partitions into three sectors of 120 deg. each, and a front of ground glass is provided. This increases the sensitiveness of the indications since the eye catches a variation in the spots of light more readily than it would a slight increase or decrease of brightness in the filament itself. This delicacy might be still further increased by setting the lamps in opaque boxes radiating from the central disk and providing each sector with a diffusing reflector which would illuminate the whole of the corresponding ground glass front, so that the effect on the eye would be not three spots but three sectors with merely thin lines of demarcation between them. This would really reduce the indicator to a three-cornered photometer on which slight variations would show. A provision for shifting the lamps along the radial boxes would accurately balance the former, eliminating special lamp selection.

The Opportunity in Congress

IT is the passage of the Webb bill, permitting combinations for export trade, that the President recommended when he told Congress this week: "The thing must be done now, because the opportunity is here and may escape us if we hesitate or delay." There was no necessity for a lengthy exposition of the purpose of the bill; the House of Representatives has acted upon it, and only the confirming vote of the Senate is awaited. The opportunity is too plain to every American to require pointing out. This is not a measure which the autocratic hand of either labor or capital is imposing upon the public. It is a constructive law which will give our manufacturers and exporters equal footing with their foreign competitors in foreign markets. It means that where export trade is concerned the extensive combinations of foreign manufacturers will be met, not by individual Americans, but by combinations of Americans. If the manufacturers contentedly read the President's approving words and the indorsement of the Federal Trade Commission and take no active steps to impress Congress they may get the law, or they may have the disappointment of seeing it lost in the shuffle of the short session. They will be much more likely to see effective enactment of the bill if they tell their Representatives what it is worth to their industries—both to the capital and to the men that work in them.

The Flow of Steam Through Pipes

IN this issue an exceedingly convenient and practical chart for the computation of steam flow is presented as devised by F. M. Hatch. The flow of steam through pipes has been repeatedly investigated with fairly concordant results, however, the large pipes found in modern power plants have hardly had their due share of attention. The theoretical considerations involved are of great interest, but from a practical standpoint the engineer has to deal chiefly with the relation between four quantities, the density of the steam at mean pressure, the quantity flowing, usually expressed in pounds per minute, the velocity, generally in feet per second, and the area of the pipe taken in square feet. The last named quantity together with the drop in pressure per unit length of pipe are generally the unknown quantities sought. The ordinary steam formulas like those of Unwin and Babcock give reasonably easy and, as experience shows, accurate solutions for the various relations required. They are not altogether simple, however, as the relations are mostly not linear and the use of a steam table is required.

Mr. Hatch has worked out a chart with the scales for the several quantities so proportioned and placed as to put the relations between the quantities in linear form, so that the necessary solution can be quickly obtained by means of a straight edge. Such a chart bears much the same relation to the computation in hand that a map on Mercator's projection does to navigation, and the examples given show the great facility with which the ordinary steam problems can be worked out. A special correction, also graphical, has been introduced for superheated steam. For most practical problems in power engineering the chart should prove extremely convenient. In only a few instances involving great differences in elevation between the ends of the line, or material loss of heat due to imperfect jacketing of the pipes, would special corrections be required. That due to elevation is pointed out by Mr. Hatch. The other would appear only in rather long lines, and obviously no generalized expression for it could be plotted.

Denver's Distribution System

RECENT changes in the distribution facilities on the system of the Denver Gas & Electric Company, as outlined by D. C. McClure in this issue, should be of interest to many engineers who have to deal with problems of growing overload. To summarize the situation, it was found two years ago that the voltage regulation was not satisfactory on account of the too great and increasing drop on the circuits and that some radical steps were necessary to overcome the difficulty. The system had simply outgrown its clothes, as often happens when an active management gets busy in a progressive community. The remedy taken was one which lends itself very readily to relief of situations of this sort, being nothing more than the transformation of a mesh-connected 2300-volt distribution into a star-connected 4000-volt system with neutral. In either case splitting the circuits into single-phase feeders from the centers of distribution is generally necessary, but it is quite as convenient in the one instance as in the other. Therefore the change was made and the single-phase feeders were linked in pairs to form the three-phase four-wire system. These feeders run to the distribution centers and from these the single-phase lines are extensively used, each consisting of one phase wire and a branch of the neutral. The combination of feeders thus made means an increase of the transmission rating for the same line losses amounting to one-third. The single-phase circuits, however, as arranged, gain nothing since the phase wire and neutral are of the same size, but the improvement up to the centers of distribution, which really deals with a large part of the loss, is marked.

The changes, evidently, involved the reconnection of transformers and as regards at least a part of the motor supply the installation of auto-transformers, bringing the voltage back to 2300. Of course, for all motors operated on the regular secondaries the change was quite simple. The power and lighting loads are connected to the same feeders, since experience has shown that the peaks occur at different times and better use of the copper is thus secured. The neutral is grounded only at the station. This three-phase four-wire system is a very convenient and practical one which has been far too little used hitherto. It is subject to certain inconveniences which are not serious, chief among which is added difficulty in running through trees, since there is now 4000 volts between any two phase wires. Under Denver conditions this is not a serious matter and can

always be remedied by a little extra care in trimming and arranging the circuits.

Another difficulty, largely theoretical, is the aggravation of the third harmonic. With a heavy mixed load this is of comparatively small consequence, particularly since the third harmonic on a 60-cycle system is not one likely to kick up serious resonance. So far as working the generators in parallel is concerned the harmonic is kept out of mischief by suitable resistance in the neutrals from generators to ground. The scheme of improvement seems to have worked out admirably and to have greatly relieved the situation.

Boiler Settings

THE importance of proper functioning of the boiler furnace is gradually being more and more fully recognized. Steam boilers have settled into a moderate number of well-known general types, of which most do not vary greatly in efficiency. The adaptation of the combustion compartment to the use of various fuels is very largely a matter of furnace design, and the problem of adjusting fuel and furnace to maximum efficiency measured in dollars and cents is just as fundamental to economy as the performance of the boiler itself. While it is almost universal practice to use mechanical stokers in large new plants, the stoker tends somewhat to complicate the situation in remodeling existing installations, since it adds to the requirements of various designs the provision of suitable space for the driving mechanism, air ducts and ash outlets. Ordinarily the countershaft of the stoker itself can be readily disposed of, either under the stoker cylinders, under the boiler-room floor or over the hoppers. The main thing is to protect it from hot ashes. The air ducts for forced drafts and the ash hopper or pit are more difficult to provide for, particularly if the boiler setting is somewhat cramped, and the article on this phase of installations elsewhere in this issue shows some of the various schemes the engineer may use to satisfy the requirements of the boiler room.

The greater difficulties arise when there is not sufficient depth under the boiler setting to allow for ready disposal of the ashes which have to be withdrawn at the side or rear. Some of the scant space available has to be taken up by the air duct, and trouble may be experienced in making the arrangement a convenient one. One of the layouts in the article to which reference is made shows into how small space the setting can be forced if necessary. It goes without saying, however, that while lack of space is a somewhat serious matter, with some types of boiler it seems almost imperative to provide a liberal amount of clearance under the boiler setting proper to facilitate ash removal, even at the cost of suitable boiler room addition. In general the article shows ingenious methods to make the best of a situation and at the same time points the plain moral that it does not pay to cramp a boiler room. An obsession of compactness has crippled the performance of many a machine and many a station, and it is quite easy to lose all the advantage of space that is gained by introducing complications. Give a good boiler a fair chance with a suitable furnace and stoker and its average performance will be very materially improved.

Wireless in Transmission Networks

COMMUNICATION between generating plants and substations constituting a power distribution system is an essential for satisfactory operation. Moreover, the communication apparatus must give immediate and reliable service. Line telephones have been largely used for this purpose, and, when proper precautions against inductive interference are taken, give good results so long as the telephone wires remain in position. When the wires come down, however, the system becomes helpless, station engineers consequently grow nervous whenever winds are high or sleet storms appear. Several progressive power transmission men are now applying the radio systems to their own peculiar problems with notable success. Since the only structures which can be affected by storms are at the operating stations themselves, maintenance labor is localized and possible interruptions may be speedily ended. In installing wireless for emergency or regular service it must be borne in mind that first cost is a relatively unimportant item. The purpose of the service is to furnish insurance; consequently, if it is to be effective, the plants must be so chosen that they can supply uniformly satisfactory communication at all times. It will not do to "save" by installing inferior apparatus or stations too small to signal reliably over the required distances. Radio telegraphy is finding new commercial uses almost daily, and the indications are that in its application to power station communication both the wireless and the transmission engineers will make material gains.

The Coming Issues

NEXT week, in the engineering number of the ELECTRICAL WORLD for December a leading article will discuss recent advance and tendencies in the installation of outdoor high-tension equipment. Vector relations in the split-phase magnet will be described in another article, which continues the treatment of the theory and operation of the split-phase magnet begun in the ELECTRICAL WORLD of Nov. 18. The fourth issue of the month, dated Dec. 23, is the commercial number, in which, besides the usual engineering departments, broad problems connected with the sale of electrical energy by central stations are dealt with. An editorial program for the Annual Review and Statistical number, Jan. 6, includes a group of articles on the developments of the industry by a representative group of men and a special statistical analysis of the year just past. The new monthly publication, ELECTRICAL MERCHANDISING, for December, will be a Christmas number, and be issued on Dec. 15.

Chronicle of Events of the Industry and of Important Movements in the Field

NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

ANNUAL MEETING OF THE A. S. M. E. IN NEW YORK

Power Plant Operation, Performance of Steam Equipment, Safety and Textile Mill Problems Among the Subjects Discussed—About 1800 Members and Guests in Attendance

With something more than 1800 registered members and guests, the American Society of Mechanical Engineers officially opened its thirty-seventh annual meeting in the Engineering Societies Building, New York, on Tuesday night of this week when Dr. D. S. Jacobus delivered the usual presidential address. The program this year was unusually heavy, calling for the presentation of forty papers at eleven sessions from Dec. 6 to Dec. 9. A large number of papers were read by title without oral discussion and brief abstracts made of others to allow time for the discussion of special topics.

PROF. IRA N. HOLLIS,
President-Elect A. S. M. E.

The following papers presented at the convention dealt with subjects closely allied with the electrical industry. "Proportioning of Surface Condensers," by George A. Orrok; "Water for Steam Boilers—Its Significance and Treatment," by Arthur C. Scott and J. R. Bailey; "Steam Safety Valves," by George H. Clark; "Standardization of Power-Plant Operating Costs," by Walter N. Polakov; "Graphic Methods of Analysis in the Design and Operation of Steam Power Plants," by R. J. S. Pigott; "Power-Plant Efficiency," by Victor J. Azbe, and "Pulverized Fuel for Locomotives," by J. E. Muhlfeld.

President's Address

In his presidential address on "Education in Engineering," Dr. D. S. Jacobus made the following suggestions: Closer co-operation should be encouraged between engineering colleges and those who employ graduates. Instead of raising the technical requirements for admission to colleges they should be lowered, and preparatory schools should be encouraged to teach good English, give broad educations and judge applicants by their initiative and general make-up. Furthermore, courses should be arranged to train the initiative and develop the human side of students. In order that professors may speak with authority, they should preferably have had practical experience in the subject or subjects taught, and should keep in touch with the field by regular practice.

Election of Officers

Following the presidential address, the following officers were elected: President, Dr. Ira N. Hollis; vice-president for two years, Charles H. Benjamin, Lafayette, Ind., Arthur M. Greene, Jr., Troy, N. Y., and Charles T. Plunkett, Adams, Mass.; managers for three years, Robert H. Fernald, Philadelphia, Pa. William B. Gregory, New Orleans, La., and C. R. Weymouth, Berkeley, Cal.

President-elect Ira N. Hollis is president of the Worcester Polytechnic Institute going there from Harvard University where he was professor of engineering. Prior to 1893 he was connected with the U. S. Navy. He has rendered notable services to the country and his profession through activity in industrial preparedness and work as a member of a commission on national defense that made recommendations to the Chamber of Commerce of the United States looking to a better navy, a better army and a legalized council on national defense and whose findings have since been practically adopted by Congress.

AMERICAN PHYSICAL SOCIETY MEETS AT CHICAGO

Short Papers on Tungsten Wire, Selenium, Corona in Hydrogen and on Other Topics of Interest in the Development of Electrical Science

At the eighty-fifth regular meeting of the American Physical Society at the University of Chicago on Dec. 2 thirty-eight papers dealing with advancement and discoveries in the science of physics were presented. In presenting their subjects, the speakers were each limited to periods of from five to ten minutes. Among the papers were the following: "Preliminary Notes on the Torsional Elasticity of Drawn Tungsten Wires," by L. P. Sieg, State University of Iowa; "Notes on the Amount of Error in Applying to Non-Parallel Plates the Formula for Electrical Capacity of Parallel Plates," by L. E. Dodd, State University of Iowa; "The Photo-Electric Emission from Crystals of Selenium," by F. C. Brown, State University of Iowa; "The Production of Light by Cathode Rays in Air," by Gordon S. Fulcher, University of Wisconsin; "Visual Diffusivity," by Herbert E. Ives, United Gas Improvement Company, Philadelphia; "Measurement of Wave Lengths with the X-Ray Spectrometer," by Elmer Dershem, State University of Iowa; "A Single Bar and Yoke Method for the Magnetic Testing of Iron Bars," by Arthur Whitmore Smith, University of Michigan; "Some Effects of Cross-Magnetizing Fields on Hysteresis," by N. H. Williams, University of Michigan; "Alternating-Current and Direct-Current Corona in Hydrogen," by John W. Davis, University of Illinois; "The Magnetic Properties of Fe, Ni and Co Above the Curie Point, and Keesom's Theory of Magnetization," by Earle M. Terry,

University of Wisconsin; "A Simple Method for Determining the Audibility Current of a Telephone Receiver," by Edward W. Washburn, University of Illinois; "An Extension of the Mayer Experiments," by R. R. Ramsey, Indiana University; "The Mass of the Electric Carrier in Copper, Silver and Aluminum," by Richard C. Tolman and T. Dale Stewart, University of Illinois; "Contact Electromotive Forces and the Energy of Emission of Electrons Under the Influence of Monochromatic Light," by R. A. Millikan, University of Chicago; "The Permanence of the Wave Length Sensibility Characteristics of Photo-Electric Cells," by Herbert E. Ives, United Gas Improvement Company, Philadelphia; "An Effect of Light on the Contact Potential of Selenium and Cuprous Oxide," by E. H. Kennard and E. O. Dieterich, University of Minnesota; "A Peculiar Gas-Crystal Resistance Change in Selenium," by W. E. Tisdale, State University of Iowa, and "Note on the Ionizing Potential of Metallic Vapors," by H. J. van der Bijl, New York City. A. D. Cole of Columbus, Ohio, is secretary of the society.

BROOKLYN EDISON COMPANY CLAIMS LARGE GOING VALUE

In Petitioning for Rehearing of Rate Case It Asks Allowance of $13,000,000 for Deficiency Below Fair Return

In applying to the New York Public Service Commission of the First District for a rehearing in its rate case the Edison Electric Illuminating Company of Brooklyn presents a computation on going value. The amount of the deficiency of net earnings below a fair return on the investment is computed as of Dec. 31, 1915, at $13,194,763. Eight per cent was applied as a reasonable rate of return.

Numerous arguments are advanced to support the petition for a rehearing and a stay of the enforcement of the order. Among these are: That the commission was without jurisdiction; no evidence was given that 11 cents per kilowatt hour furnishes a return in excess of the cost to consumers entitled to that rate; the commission made no allocation of expense to different classes and its finding of discrimination was not supported by evidence; it has authority to establish only maximum price and no power to promulgate binding schedules; it is without power to order elimination of rates based on quantity consumption and there was no proof to support the conclusion that quantity discounts result in unjust discrimination; the rates made by the commission are unjust, unreasonable and discriminatory between different classes; the deduction of $7,140,000 from property account for so-called depreciation is without warrant of law.

AMERICA'S ELECTRICAL WEEK VERY SUCCESSFUL

Permanent Flood-Lighting of Statue of Liberty at Signal from President Wilson Leads Off Celebration

All this week the electrical interests of the nation have been participating in the celebration of America's Electrical Week. From coast to coast and from border to border special features were planned to stimulate the interest of the public in electricity. In all more than 100 electrical shows were held, each supported by local interests. A number of public groups of buildings and monuments were permanently flood-lighted. National popular periodicals of more than 7,000,000 circulation devoted their entire first issues in December to electricity. In addition, newspapers in practically every city in the United States of any size devoted during the week some space to electricity. From every angle the week was a success, both nationally and locally. The local side of the celebration will be given in detail in next week's issue of the ELECTRICAL WORLD.

LIBERTY PERMANENTLY FLOOD LIGHTED
(Idea Suggested by George Williams and Funds Supplied Through New York World)

On Saturday night, Dec. 2, the Statue of Liberty was permanently flood-lighted at a wireless signal from President Wilson, who had come to New York for the ceremonies.

Following the lighting of the statue the President and Mrs. Wilson were escorted to the Waldorf-Astoria up Broadway, which was specially illuminated, to the City Hall, which was decorated by a huge electric flag, then up to Fifth Avenue to the hotel. Fifth Avenue was transformed for the night by the New York Edison Company into a path of gold. The 400-watt type-C street lamps were changed for 750-watt type-C lamps and for the ground glass globes were substituted ones of tinted amber, giving a golden effect.

At the banquet at the Waldorf-Astoria, after President Wilson had made the pregnant remark that "peace can come only with liberty, not while destinies are ruled by small, selfish groups," Chauncey M. Depew; Jules J. Jusserand, the French ambassador; Ralph Pulitzer of the New York *World* and Henry L. Doherty, president of the Society for Electrical Development, delivered addresses.

Speaking on "The Science of Electricity," Mr. Doherty said:

"I assume that the word science shall be interpreted in its broadest sense. The great epoch of making electricity the servant of man was ushered in by the discovery of how to generate electricity by mechanical methods. The whole science has been developed during

the lifetime of a majority of the men who sit about these tables.

"If any one of you has occasion to talk to a body of real scientists, do not loosely repeat the old, worn-out statement that 'the science of electricity is only in its infancy.' The science of electricity is far in advance of every other science of its general class.

"Every transformation of one form of electricity to some other form of electricity is accomplished with marvelously high efficiency, leaving little to be gained even if perfection should be reached.

"But electrical energy must be derived from and converted into other forms of energy, and it is within these kindred and allied sciences that big losses are sustained, and it is these sciences which may be said to be still in their infancy, even though centuries old.

"The magnitude of the task before us can only be appreciated when you remember that whenever you see a man, woman or child doing any form of human labor, that that labor can either be reduced or wholly eliminated by the use of electricity. Millions of people every day are fatigued with labor that it is not necessary for them to do. You can state the case in any terms you want; that electricity will make human labor more productive; that it will lessen fatigue; that it will make human labor more efficient, but it all comes back to the fact that every form of human labor can be eliminated or reduced by means of electricity."

MERGER OF CALIFORNIA HYDROELECTRIC SYSTEMS

Operating and Other Economies Resulting from Consolidating the Two Immense Systems of the Southern California Edison Company and Pacific Light & Power Corporation

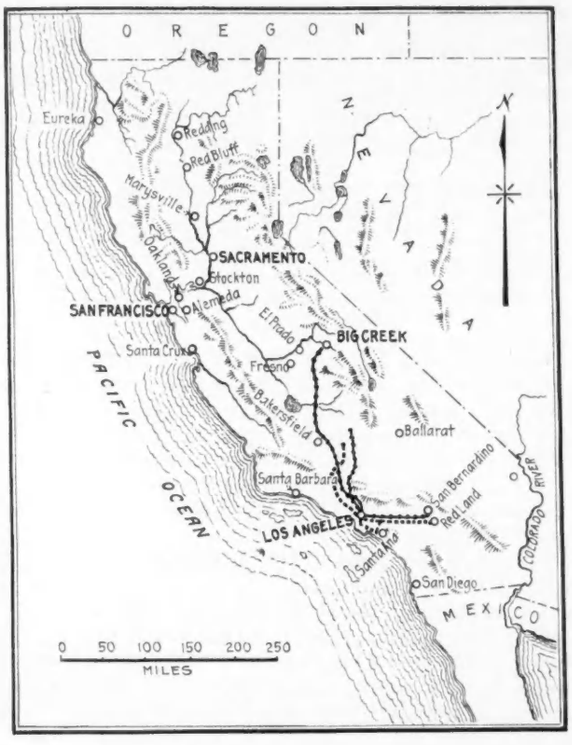
There have been many rumors during recent months pointing to a consolidation of large electrical interests in southern California, but nothing definite has been made known until Dec. 1, when an application was filed with the State Railroad Commission by the Southern California Edison Company and the Pacific Light & Power Corporation for authority to consolidate the properties of the two companies. The consolidated properties, which will also include the Ventura County Power Company, will operate under the name of Southern California Edison Company, which will then be one of the first half dozen in size of the electric operating companies in the United States.

At various times during the past ten years there have been negotiations regarding the union of these two systems, but only recently has a satisfactory basis been reached, and a definite agreement concluded which is of undoubted advantage to both the companies and the communities they serve. This merger of what are really vast interests is undoubtedly along the lines of wise business policy. The two electric companies have been operating side by side in a rapidly growing territory, competing keenly for business in numerous centers, and to some extent duplicating investment and wasting energy which could be better utilized in other directions. The result of the consolidation will mean a co-operation of brains and capital which should redound to the benefit of all concerned.

When the transfer is completed, the Southern California Edison Company will own and operate five steam generating plants with a rated capacity of 130,000 hp. and thirteen hydroelectric generating plants, including the wonderful Big Creek plant, with a capacity in excess of 150,000 hp. The combined generating capacity will be nearly 300,000 hp. There are also owned undeveloped hydroelectric generating properties, capable of adding 400,000 hp. There are 1400 miles of transmission lines delivering energy to 103 substations, and therefrom carried over a total of 3700 miles of distributing lines to 165,000 consumers located in 150 cities and towns and the intervening territory in southern California.

Financial Arrangements

The Southern California Edison Company will take over and hold as part of its assets approximately 95 per cent of the outstanding capital stock of the Pacific Light & Power Corporation, and assume its bonded indebtedness amounting to $25,000,000. The stock issues consist of $4,716,500 first preferred stock, $9,660,000 second preferred stock, and $10,468,500 common stock. The Edison company will also purchase and hold $5,000,000 of the outstanding bonds of the Pacific Light & Power Corporation and that corporation's notes amounting to $1,096,048. The Edison company will also acquire, as part of the transaction, all of the outstanding capital stock of the Ventura County Power Company, consisting of $341,750 preferred stock and $704,500 common stock.

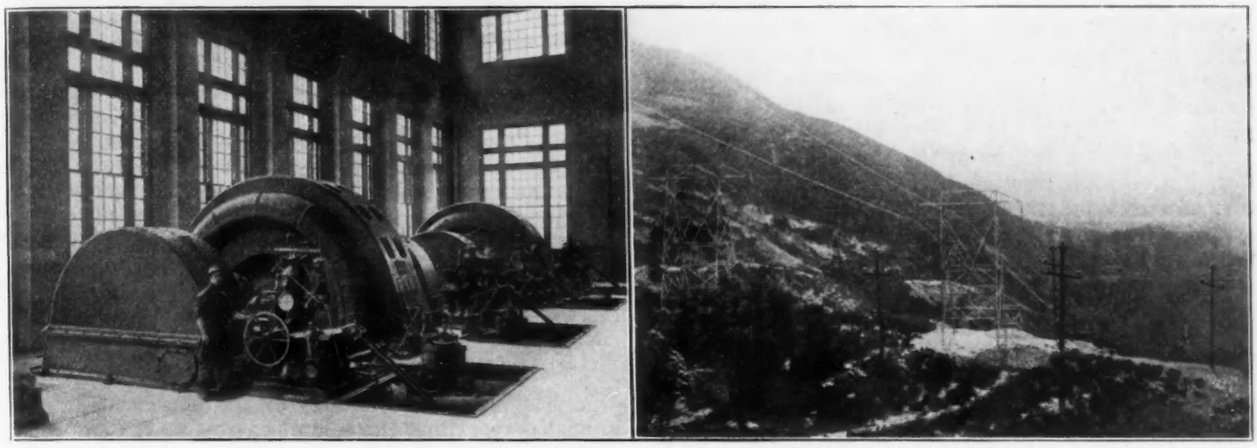


COMBINED SYSTEM COVERS IMMENSE SECTION OF CALIFORNIA

The stocks, bonds and notes to be taken over by the Southern California Edison Company have a face value of $31,880,298. The Edison company will issue $12,029,900 of its 5 per cent second preferred stock and give $4,000,000 in cash on account of the purchase of the stocks and bonds, and will also issue $11,152,200 of its common stock to the Pacific Light & Power Corporation, which stock will remain in the treasury of the corporation. By reason of its ownership of 95 per cent of the stock of the Pacific Light & Power Corporation which it will acquire from Henry E. Huntington, the Edison company will in reality own nearly all of this $11,152,000 of common stock to be issued to the Pacific Light

& Power Corporation, so that in the final analysis only approximately $550,000 of this will be actually outstanding as capital.

Henry E. Huntington will become the largest individual stockholder in the Southern California Edison Company by reason of his ownership of more than $12,000,000 of its second preferred stock. The financial arrangement covering the merger precludes the necessity of borrowing money or pledging the Southern California Edison Company's securities or credit in connection with the purchase of the properties of the Pacific Light & Power Corporation.

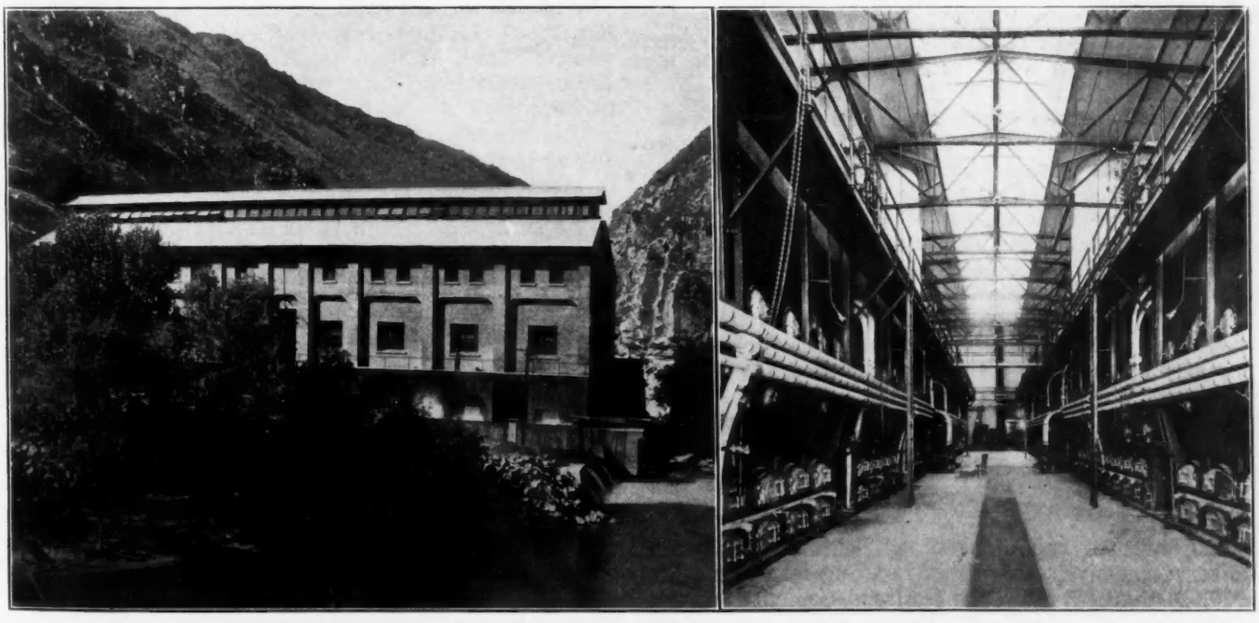


BIG CREEK STATION AND TRANSMISSION LINES OF THE PACIFIC LIGHT AND POWER CORPORATION

ECONOMIES EXPECTED FROM CONSOLIDATION

The two enterprises under one head will give much better service to the public, and at the same time save considerable operating and administrative expenses, as also considerable interest on investment. From an operative standpoint, the union of the two properties will mean many advantages. The immediate effect will be that the Southern California Edison Company's present business will turn over to the Pacific Light & Power Corporation's recently developed Big Creek hydroelectric plant, a large load which is now being carried by steam plants. This will result in a large economy in generation costs. The tying in of the two properties will add to each a greater reserve of power, and an assurance of continuity of service heretofore unequaled in the electrical distributing business.

The announcement of the consolidation at this critical period in the negotiations between the city of Los Angeles and the companies for the purchase by the city of the Los Angeles distributing systems is taken to mean that the Edison-Pacific interests are preparing the way for the acceptance of the city's offer. By consolidating all the operation within the city under one ownership, *i.e.*, the city of Los Angeles, and all the business outside the city under one ownership, *i.e.*, the Southern California Edison Company, the lines of ownership will be so distinctly drawn that it may be reasonably expected the city and the Edison company will be able to harmonize on all matters and co-operate toward the end of building up a wonderfully developed and remarkably efficient electric distributing system.



KERN RIVER STATION AND OIL BURNING BOILERS AT LONG BEACH STATION OF SOUTHERN CALIFORNIA EDISON COMPANY

After the Railroad Commission has approved the plans for consolidation some weeks will be required to work out the details of tying the two extensive properties together and getting the system and departments synchronized, but doubtless no time will be lost in this connection.

POWER COMPANIES ACCEPT OFFER OF LOS ANGELES

City Will Submit Bond Measure to Vote After Contract with Southern California Edison and Pacific Light & Power Companies Is Executed

The board of directors of Southern California Edison Company at a special meeting held on Dec. 4 formally accepted the offer made by the city of Los Angeles to purchase the company's distributing system in Los Angeles.

The board of directors of the Pacific Light & Power Corporation at a meeting held on the same date also formally accepted the city's offer for its distributing system. The resolutions of the directors of both companies were practically the same and read as follows:

> Resolved that the recommendation made by a special committee composed of the Mayor, two members of the City Council, and two members of the Board of Public Service Commissioners of the city of Los Angeles, to the board of Public Service Commissioners of the city of Los Angeles by written report made to said board dated Nov. 29, 1916, and by said board approved by resolution adopted on Nov. 29, 1916, be approved and accepted by this corporation as a basis from which to formulate contracts for the sale by this corporation of its electric distributing system within the city of Los Angeles to said municipality, and for the sale by this corporation, and the purchase by Los Angeles City of electric energy, under which contracts this corporation will be reimbursed for the loss it will sustain by reason of the severance of its Los Angeles distributing system from the balance of its property, and in the delivery of its property free of incumbrance.
>
> Further resolved, that the vice-president of this corporation present to the trustees under the trust deeds covering this corporation's electric distributing system in the city of Los Angeles the matter of the proposed sale of such distributing system to the city of Los Angeles, with a view of securing releases of said property from the lien of such trust deeds.

Mayor Woodman on Tuesday expressed himself as being in favor of submitting a bond proposition to a vote of the people at the earliest possible moment after the contract between the city and the power companies has been prepared and executed. He stated further that this bond election would probably be held within the next thirty days.

The public service commission has in course of preparation a communication which will contain a complete analysis of the proposal of the city for the city for the purchase of the two distributing systems, with a statement of the proposed method of payment, and the manner in which the income from the business thus secured will pay for the proposed municipal indebtedness to be incurred in connection with the acquisition of the two systems. The purpose of this information is to acquaint the voters of Los Angeles with the advantages of the purchase of the distributing systems of the two power companies which will eliminate the necessity of paralleling existing lines and the consequent economic loss, which loss, if incurred, must eventually be paid by the consumers.

Agreement Between Power Companies and City

The value of the property of Southern California Edison Company in the city of Los Angeles on June 30, 1915, as fixed by the State Railroad Commission, was $4,750,000. Additions to the Edison property from July 1, 1915, to end of 1916, amounted to $232,104, making a total of $4,982,104, not including the Los Angeles No. 3 steam plant, the ownership of which will be retained by the Edison company.

Upon the same basis of valuation, the value of Pacific Light & Power Corporation's Los Angeles property was fixed at $3,288,813. The combined valuation of the physical properties of two companies in Los Angeles is therefore $8,270,917.

The Railroad Commission, in its opinion given as a result of hearing in the so-called Los Angeles condemnation case, fixed the severance damage to the Edison company, if its Los Angeles properties were taken, at $1,578,000 The agreement with the city now includes allowance for severance of $841,201, and included in the contract for service there is a further allowance on account of severance damage amounting to $736,799. Thus the total amount of severance damage to Edison company ($1,578,000) as fixed by the commission is taken care of and will eventually be paid. Upon the same basis the Pacific Light & Power Corporation is allowed in the power rate a severance damage of $408,201, making a combined allowance of $1,145,000 to the two companies in the rates for energy to be supplied to the city for the first ten years after the properties have been delivered to the city.

Details of Contract for Electricity

A most important feature of the agreement is the provision regarding the sale of energy by the two companies to the city. For the first ten years the city guarantees to take a minimum of from 50 per cent to 25 per cent of total city maximum demand. When it completes its first hydroelectric plant the city will have about enough power available to supply one-half of the total demand. Hence the power companies will have to make up the difference until other proposed city plants are completed, and in any event during the ten-year period the city must take not less than 25 per cent of its requirements from the two power companies.

Electricity will be supplied to the city upon a load factor schedule ranging from a minimum load factor of 36 per cent to a maximum of 60 per cent. The price for energy is based upon the companies' costs, including 8 per cent for interest, plus the addition agreed upon for severance damage. The power agreement is for a period of thirty years. After the first ten years the city agrees to take from the companies all the energy it will use over and above that generated by its hydroelectric plants, at rates to be then fixed by the State Railroad Commission, or such legal authority as may be in control.

This power arrangement will be of advantage to the city in that it will not be called upon to invest capital in steam standby plants, but will at all times have a permanent supply to draw upon under extremely satisfactory conditions. Both the power companies have contracts with electric railroads for the sale of large amounts of power. These contracts the companies will retain and continue to meet the present and future demands of the railroads for electric energy.

One Company Withdraws from Negotiations

Until within one week from the date the agreement with the city was reached, the Los Angeles Gas & Electric Corporation was lined up with the Southern California Edison Company and the Pacific Light & Power Corporation in all the negotiations, but eventually withdrew. In its letter of withdrawal addressed to the Mayor the Los Angeles Gas & Electric Corporation stated it was compelled to take such a step by the deliberate action of certain representatives of the city, which action tended to cripple and injure the business of the corporation, and its value, pending the negotiations for sale. The Los Angeles Gas & Electric Corporation is the oldest electric company in the city, and has lighted the streets since 1883.

The proposed agreement must be approved on behalf of the companies by the directors, and later by the

trustees of the properties. On the city's side, there must be submitted to the people a charter amendment, which, if carried, must be later approved by the State Legislature. Then a bond election for probably $12,000,000 would follow.

ELECTRICAL STATISTICS OF LOS ANGELES

The population of the city of Los Angeles is about 500,000, and the total number of electric consumers in the city is approximately 125,000. Of this amount over 82,000 will be turned over to the city of Los Angeles by the Southern California Edison Company and the Pacific Light & Power Corporation. The peak demand of entire city load, exclusive of railroad load, is well over 40,000 kw. Of this amount 30,000 kw. represents the combined peak of the two companies selling their properties to the city. The combined load factor on maximum peak is close to 40 per cent.

Electrically speaking, the city of Los Angeles is remarkably well developed. The fact that three companies have been competing for business for fifteen years past has naturally stimulated the growth. The lighting load approximates 125,000 kw. For power purposes there are in use 10,000 motors representing a total capacity of over 100,000 hp. In addition there are in every-day use in excess of 100,000 lamp socket appliances for heating and cooking purposes. The consumption of electric energy is in the neighborhood of $9 per capita.

Although the city of Los Angeles objected to the decision of the State Railroad Commission in the Edison condemnation case, and asked for a rehearing, which request was denied, said decision has been the basis for the negotiations which have led up to the city's offer for the Edison-Pacific distributing systems. On Dec. 1 the commission vacated the order regarding the Edison case, the city having taken no formal action in the matter within the required time.

HIGH COST OF FUEL OFFSET BY PLANT INTERCONNECTION

Negotiations Pending Between Fall River and New England Power Companies for Interchange of Energy Will Effect Mutual Savings

Negotiations are under way between the Fall River Electric Light Company and the New England Power Company for the connection of the Fall River company's steam turbine plant at Fall River with the latter system. It is planned to build a 66,000-volt steel tower transmission line from Fall River to the Rhode Island State Line, and thence to the Pawtucket substation of the New England system. Rapid growth of business at Fall River has necessitated the provision of 6500 kw. additional capacity and future textile mill and other business warrants arrangements for additional power.

The Fall River company operates a modern plant of about 16,000 kw. rating on tide water at the foot of Hathaway Street, and if the negotiations are successfully concluded for reciprocal power supply, construction will be completed by the fall of 1917. An 1800-ft. span across tidewater between Fall River and Somerset will be necessary, and it is planned to construct the line of 5/8-in. copper-clad steel cable carried on insulators supported by towers 240 ft. high.

A. H. Kimball, general manager of the Fall River company, said recently that if the new line is built, the arrangement will enable the company to minimize its reserve capacity and tend to offset the present high cost of fuel. Ultimately it will probably be necessary to build a large plant to handle the Fall River service.

OVERWHELMING MAJORITY FOR DALLAS FRANCHISES

14,613 Out of 15,260 Votes Cast Favor Plan Whereby Public Shares Equally With Capital in Excess Earnings

The taking of the postcard vote on the Dallas railway and lighting franchises which was in process for two weeks closed on Monday last. Out of a total of 15,260 votes cast 14,613 or more than 95 per cent were in favor of the proposed franchises whereby rates are automatically lowered as reserves increased and the public is made to share with capital increased profits. The essential features of the franchises were outlined in the ELECTRICAL WORLD for Nov. 25, page 1043.

According to the agreement made before the vote was taken the city will now grant to the lighting and railway operators franchises substantially as proposed to the voters.

Those who planned this action and proposed this form of franchise are very gratified at the overwhelming majority which the voters of Dallas gave to the franchises. This is undoubtedly the greatest demonstration of the desire of the public to keep the operation of public utilities in private hands where capital shows a desire to operate the properties in the best interests of all.

NO WATER POWER LEGISLATION LIKELY BY PRESENT CONGRESS

Matters of Interest to Electrical Industry Will Be Displaced Apparently by More Pressing Measures During Short Session

The second session of the Sixty-fourth Congress—which by limitation of law is the "short" session and must end March 4 next—began in Washington on Monday. For reasons connected with the European war, with present condition of American industries, and with the problems these industries must face when the war ends, the coming session will be the most important session of Congress from a business point of view that has been held since 1812.

When the estimates were presented to Congress on Monday by the Secretary of the Treasury, it was found that it is proposed to appropriate the enormous sum of $1,268,715,834.03. This is exclusive of sinking-fund requirements and expense for the Postal Service, as the latter is supposed to maintain itself, through an income and outgo of $325,000,000.

There are fourteen big appropriation bills, and each, in the opinion of experts, will require at least a week's time for consideration in Congress. On this basis there will be no time left for the consideration of any measures other than the appropriation bills.

There are 100 bills now pending on the calendars of Congress which will complicate the situation if called up and delay the work of the session. The water power bill is in conference, and there is certain to be a debate if an attempt is made to adopt a conference report. Unless there is an equalization of opposing interests on different proposed measures, it is extremely unlikely that there will be any water power legislation of moment at the coming session. The bill to provide for the leasing of irrigable arid lands is pending in the Senate. The immigration bill, the measure to regulate the hours of all railroad employees, the bill to increase the membership of the Interstate Commerce Commission, and many others are in favorable position to be called up and debated interminably.

President Wilson is keeping his plans to himself, but it is indicated at the White House that he will press

very hard for the passage of legislation concerning threatened railroad strikes, and there is reason for the belief that he will regard an extra session with less disfavor than the postponing for a long time of legislation for the settlement of strikes that threaten the food supplies of the people and the business of the country. It is stated that the President would not fear a House of Representatives organized by the Republicans, as the next House may be, for he does not regard his recommendations as to railway strike prevention as partisan. Then, too, the extra session possibility will loom much larger if the Supreme Court of the United States declares the recently enacted so-called Adamson eight-hour law unconstitutional, for that would force the whole question of hours, wages and the public interest directly upon Congress.

Some of the economists at Washington are studying what happened to the country in 1812, when Great Britain dumped all sorts of goods on to the United States, to the ruination of the struggling baby industries of those days. The administration of President Monroe faced exactly the same problems that are being faced now, except for the difference in volume. For this reason there is every likelihood that if Representative Fitzgerald forces his "food embargo" proposition through it will go through with teeth in it that will make it strongly resemble a tariff act, a real "anti-dumping" act.

CANADIAN CABINET CONSIDERS NIAGARA POWER CONTROVERSY

Pending Its Decision no Embargo Will Be Placed on Electricity Exported to the United States from Niagara Stations

Pending a decision by the Canadian cabinet, which has been holding a series of conferences with representatives of the Ontario Hydro-Electric Commission and Canadian-Niagara power generating companies, there will be no absolute embargo on the exportation of Canadian power to American consumers. E. L. Patenaude, Minister of Inland Revenue, who has control of power exportation licenses, and his cabinet colleagues from the province of Ontario, Sir George Foster and Frank Cochrane, are now reviewing evidence submitted by the Ontario commission, which is urging the embargo, and the Canadian-Niagara power companies who desire to continue their American contracts. Although the hearings were private, those who appeared before the federal cabinet were given the impression that a compromise will probably be agreed upon.

While the matter is being considered by the Canadian cabinet, efforts will be made for a satisfactory working agreement between the provincial commission and the private generating companies for a fair distribution of power to both Ontario and American consumers. Some of the latter are engaged on munitions work for the Allies, and the Imperial munitions board at Ottawa, Ont., is urging that their supply of power be not curtailed.

The Ontario Hydro-Electric Commission was represented at the Ottawa hearing by Sir Adam Beck, chairman; I. K. Lucas, attorney general of Ontario; W. K. McNaught and F. A. Gaby, electrical engineer. The Canadian Niagara Power Company was represented by Wallace Nesbitt, K.C., Monroe Grier, K.C., and Philip Barton, general manager. Among those who appeared for the Electric Development Company of Toronto was R. J. Fleming, manager; James Bain, K.C., and A. W. Anglin, K.C., appeared for the Ontario Power Company.

Representatives of the power development companies asked for renewal of their export licenses, which expired last April. These new licenses have been held in abeyance because of the controversy between the provincial commission and the power companies. The generating companies contended they have entered into agreements with United States companies for the exportation of power and, that if the licenses to export were cancelled, then the Hydro would be required to pay a price for power equal to that exacted from American industries. Opposing the application of the power companies, Sir Adam Beck declared the companies knew of the existence of clause V of the power fluid act of 1906 when they entered into the United States contracts. This clause provides that license to export power be limited to the surplus over and above what was needed for Canadian requirements. These have been estimated by Sir Adam Beck at over 100,000 hp. for the year 1917 alone.

Western New York industries dependent upon Canadian power are watching with interest the developments in official channels at Ottawa, for any absolute embargo on the exportation of Canadian power to American consumers would have a demoralizing effect upon industries in this section of the country. Hundreds of Buffalo and Niagara Falls industries are now feeling the effects of the partial embargo which has been in effect for some time, and great pressure is being brought by these industries upon the United States authorities for increased diversion of water from the American channel.

Some relief from the power shortage which has been experienced for the last five weeks was obtained on Dec. 4, when the first unit of the new steam-generating station of the Buffalo General Electric Company was placed in operation. The first block of 25,000 hp. is being generated and the second block of 25,000 hp. will be ready about Jan. 1. Construction work is being rushed continuously so that the maximum capacity of 80,000 hp., which will be generated in the plant now under construction, can be reached as rapidly as possible.

The Electrical World's

STREET-LIGHTING TABLES

for 1917

For twenty-eight consecutive years the Electrical World has prepared tables showing the time for lighting and extinguishing street lamps. These tables for 1917 are now ready, and will be sent free to any reader addressing the Electrical World, 239 West Thirty-ninth Street, New York City. The tables show the times of lighting and extinguishing lamps on the all-night schedule, the moonlight schedule, and the Freund system. In the all-night schedule the lamps are lighted one-half hour after sunset and are extinguished one hour before sunrise, giving a yearly operation of about 3830 hours. In the so-called "Philadelphia moonlight schedule," advantage is taken of the moonlight, and on nights when the moon is full, or nearly so, the lamps are not lighted. On other moonlight nights the lamps are extinguished one hour after moonrise and lighted one hour before moonset. With this schedule the lamps are in operation about 2000 hours per year. A third set of figures has been calculated according to the system of Mr. Freund, which ignores the moon until after midnight throughout the year. This schedule entails the use of lamps about 3000 hours a year.

Changes That Increase Denver's Electrical Distribution Facilities

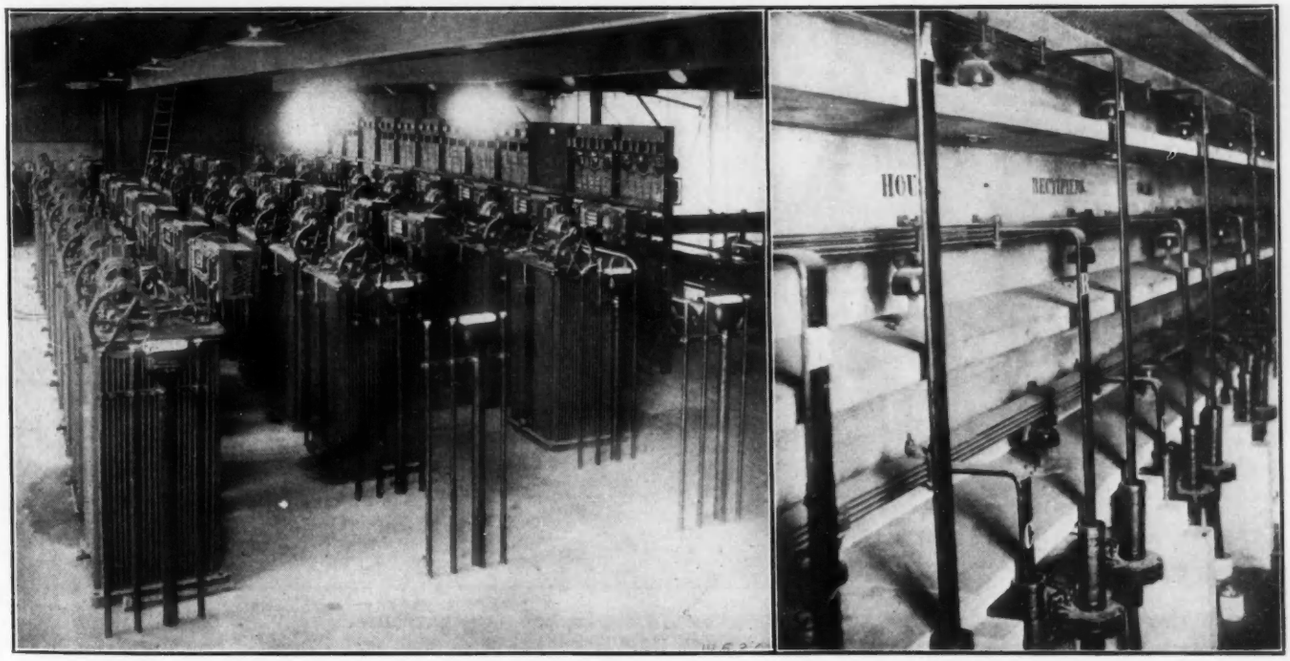
BY D. C. MCCLURE
Engineer with Denver Gas & Electric Light Company

Loads on the Denver Gas & Electric Light Company's system have grown so large that a new system of distribution has been required. In order not to interrupt service and to utilize as much of the old equipment as possible, the three-wire single-phase and three-phase 2300-volt system, which has been used for years, has been converted into a four-wire three-phase 4000-volt system. The changes involved in this transformation are outlined in what follows. Among the subjects considered are the general arrangements of the substation, construction of bus and switch compartments, disposition of transformers and regulators, provisions for protecting circuits, changes in the distribution system, and arrangements for using energy generated by hydroelectric or steam plants.

FOLLOWING an investigation in 1914 of the Denver Gas & Electric Light Company's system it was decided that the entire system would have to be overhauled to make the voltage regulation satisfactory. Switch apparatus and panel equipment were found to be inadequate for the service demanded, the single-phase and three-phase city feeders had outgrown their switch ratings, and the main bus-tie switch was loaded beyond a value which could be considered good practice for so important an element in the system. Furthermore, the feeder copper was excessive, having been increased from time to time to reduce the line drop. It was not considered advisable, however, to split the feeders up, as it would make overhead distribution more noticeable. Since a three-wire single-phase and three-phase 2300-volt distribution system had been used up to this time, everything pointed favorably to the adoption of a four-wire 4000-volt distribution system.

After studying different substation arrangements that have given satisfaction on such systems it was decided to erect a three-elevation gallery in the West Side station to accommodate the new apparatus made necessary by the change. The relative positions of equipment that this arrangement afforded are shown in Fig. 6, while the electrical connections are shown in Fig. 7. The latter also shows connections with the Colorado Power Company, from which the Denver company purchases practically all of the energy it distributes. It may be remarked at this point that while sufficient steam generating equipment is installed in the West Side and Lacombe power plants of the Denver company to carry the system's peak load (14,000 kw.), this apparatus is only held in reserve to carry peaks and emergency loads.

The top gallery of the new three-gallery substation contains a thirteen-panel generating switchboard, a



FIGS. 1 AND 2—GROUP OF INDUCTION REGULATORS AND PORTION OF BUS STRUCTURE

This particular system was considered with favor because its adoption would only involve an increase in voltage and number of phases which could be obtained by reconnecting the transformer banks and main generating units in star for 4000 volts. Another advantage seen in the four-wire system was that two single-phase feeders could be combined into one three-phase four-wire feeder.

thirteen-panel feeder board and thirty 44-kva. single-phase Westinghouse automatically controlled induction regulators. The latter are directly back of the feeder panels and are arranged in three rows, one for each phase, about 3 ft. 8 in. apart. One of these units is installed in each leg of each three-phase lighting feeder. Besides carrying the usual auxiliary apparatus mounted on them by the manufacturers, the regulators support

special frames carrying Westinghouse type H compensators and secondary relays. With the arrangements mentioned very simple and short control cable runs are permitted between the regulators and the feeder switchboard on which the primary regulator relays and regulator motor-control switches are mounted.

The feeder panels which consist of a black marine slate measure 9 in. by 32 in. by 2 in. Arranged on each lighting feeder panel in three distinct phase sections, in the order given below, are three type SM voltmeters, three type SM single-phase indicating wattmeters, three type C single-phase watt-hour meters, three control switches for operating breakers tied to the Colorado Power Company, three control switches for operating oil-circuit breakers tied to the Denver company's bus, three control switches for changing the automatically controlled induction regulators to hand-control, three primary relays for control of the regulators, and three type CO definite-minimum, inverse-time-element relays, for overload tripping of the oil-circuit breakers. All conductors leading to the panels emerge at the floor level through a single row of 1-in. conduits and connect with terminal boards bearing fuses and circuit identification marks. Fifteen conduits open at each panel. Colored multi-conductor control cables are used extensively, their insulation consisting of rubber and flame-proof braid. Many of the generating panels have the same dimensions as the feeder panels but some are half the width (32 in.). The panels were drilled and wired at the station so as much of the existing equipment as possible could be utilized.

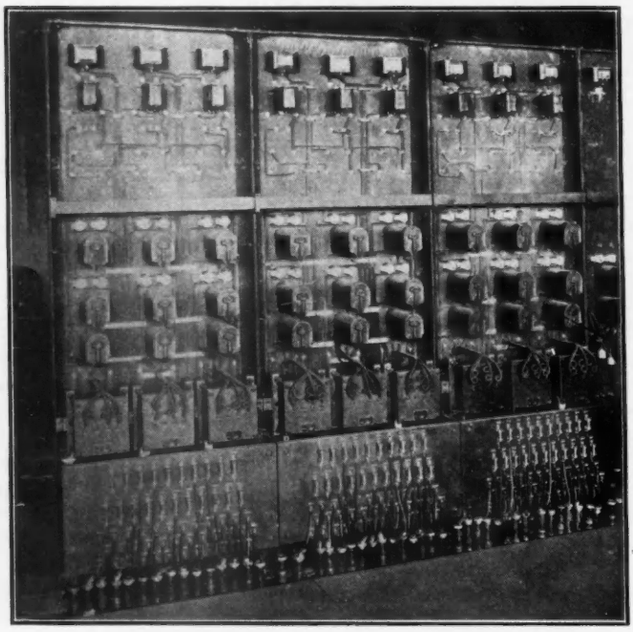
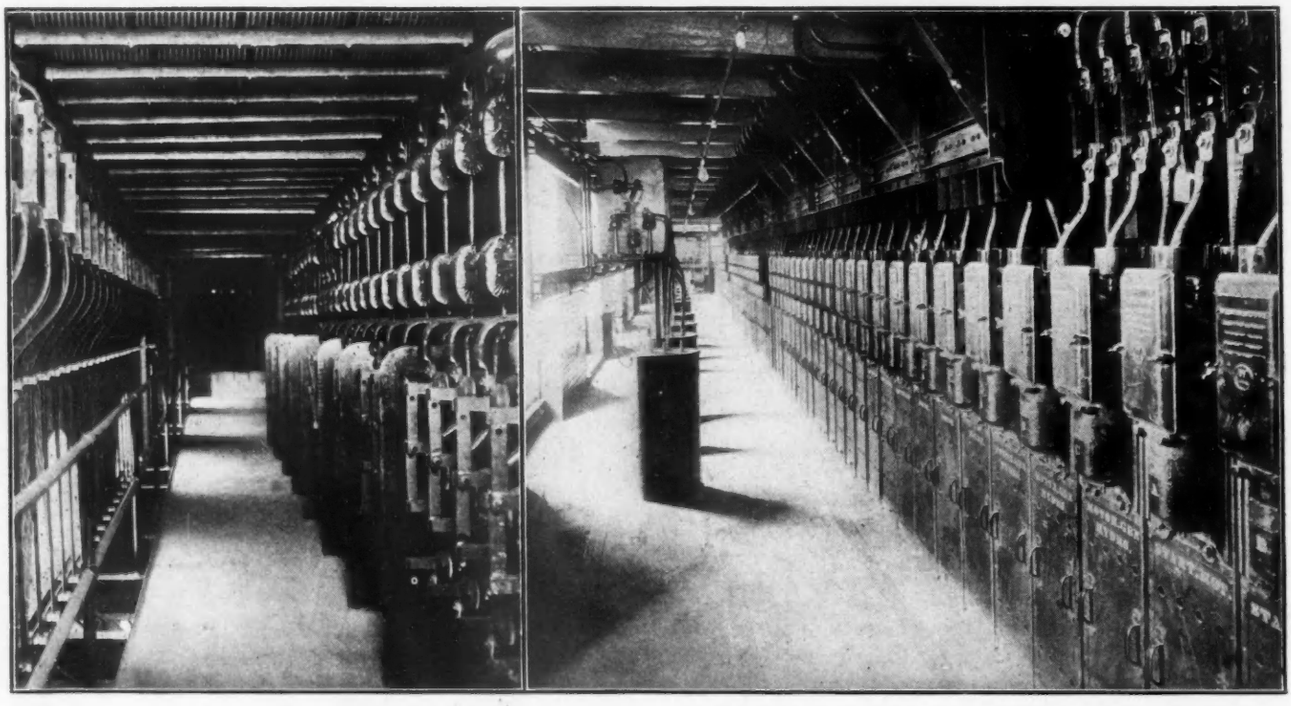


FIG. 3—REAR OF FEEDER PANELS, SHOWING CONTROL CONDUITS AND TERMINAL BOARDS

On the second or sub-gallery are the bus structure, choke coils, disconnecting switches, and a frame for supporting instrument transformers, selector-type disconnecting switches, and emergency feeder bus. To permit running the main and auxiliary circuits for each feeder in separate compartments the floor beams on each floor are placed 42 in. apart, to correspond with the feeder spacing adopted. In the floor of each gallery along one whole side of the substation is a railed-in slot through which feeder cables, conduits and auxiliary circuits may be led from one elevation to another. This slot also serves for ventilation.

The bus structure, which is arranged for a double-bus system, is 6 ft. 6 in. high by 100 ft. long, and is composed of gray pressed brick with slate partitions or bus shelves. One end of the structure is for the bus-tie connections and a central portion for emergency connections. The bus nearest the gallery front is for generation and connects all machines, substations and feeders. On the other side of the structure, separated from the generation bus by an 8-in. dividing wall, is a bus connecting the Denver system with the incoming Colorado Power Company's circuits.



FIGS. 4 AND 5—INSTRUMENT TRANSFORMER FRAME CARRYING EMERGENCY BUS SWITCHES AND VIEW OF LIGHTNING ARRESTERS AND CIRCUIT BREAKERS

Four 3-in. by 0.25-in. copper straps laid horizontally with 0.25-in. spacing are used for the generation bus,

while a bus tapering from four straps to two straps is used for the incoming energy. The buses are supported on vertical pin-type Westinghouse bus supports, which are carried on the slate shelves. These shelves are 2 in. thick and extend through the dividing wall, serving the same purpose on each side. Approximately 2800 ft. of copper is used in this bus.

Connections with the disconnecting switches on the main floor below are run through porcelain floor bushings, set 14 in. center-to-center, to conform with the

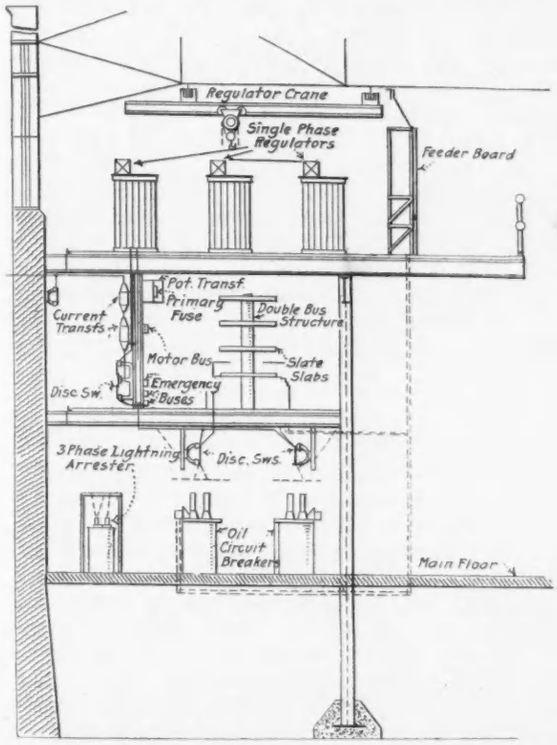


FIG. 6—RELATIVE POSITIONS OF SUBSTATION EQUIPMENT

at the rear of the sub-gallery. Besides serving the purpose mentioned it carries the leads from the regulators above to their respective circuit breakers below and supports an emergency bus and regulator-motor bus.

Two current transformers are used per phase. These instruments and the potential transformer are connected with the single-phase switchboard instruments and voltage compensators. Connected with the return regulator leads and emergency bus are double-throw twin-blade transfer switches, the hinges of which are joined with cables, each of which passes through the current and potential transformers and thence to the incoming lines through aluminum choke coils 7 in. in diameter and 44 in. long. A neutral compensator with a current transformer is provided for the purpose of using phase-voltage regulators to handle and regulate feeder pressure due to unbalanced currents in the neutral.

Electrolytic lightning arresters and a double row of single-pole circuit breakers with separate solenoid control and disconnecting switches in each leg are installed on the main floor. The circuit breakers are of the Westinghouse E 10 type and are rated at 300 to 1200 amp. and 13,200 volts. Separate fireproof compartments are provided for each pole and are built with 4-in. walls of gray pressed brick laid in cement mortar. The top of the compartments are covered with steel plates and angles for supporting the separate switch poles. Since the angles and plates are bolted down to the main floor a permanently strong fireproof arrangement is provided. Each compartment is approximately 10 in. by 24 in. by 48 in., making the total length of the compartments,

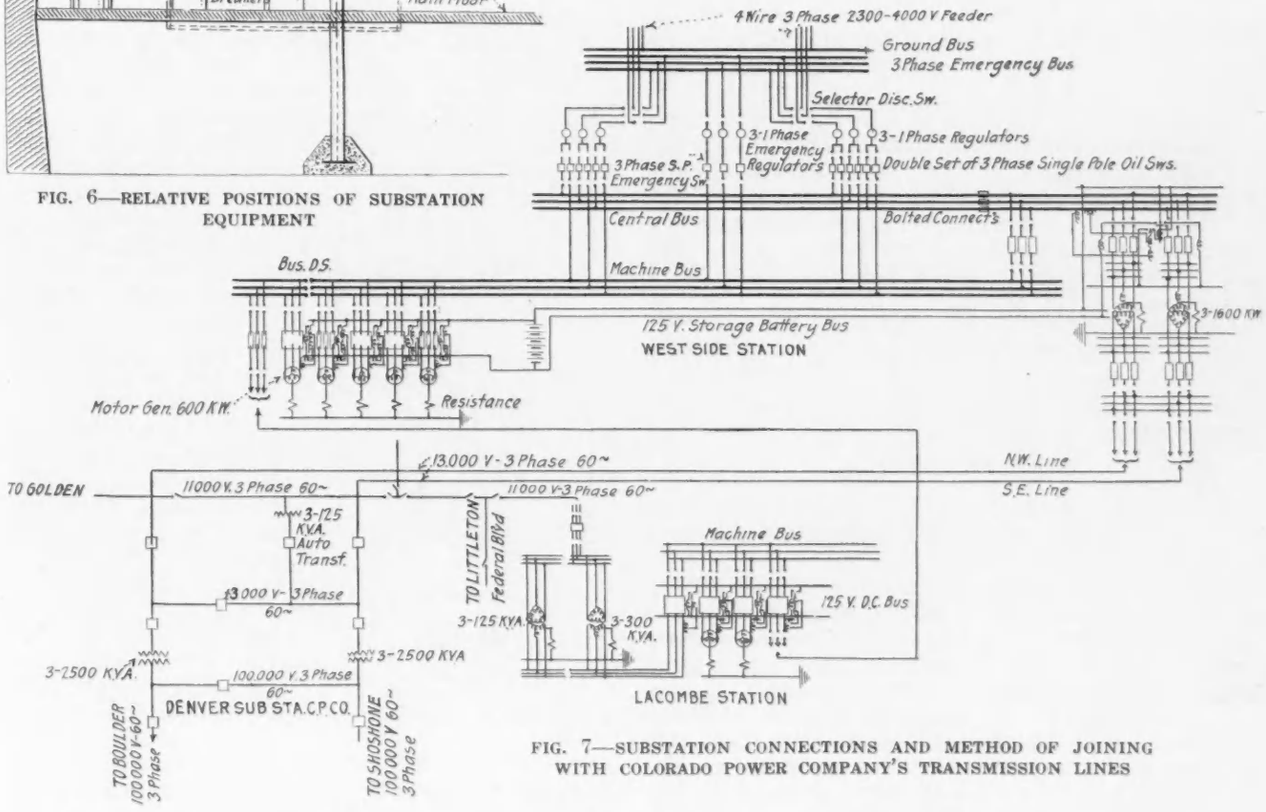


FIG. 7—SUBSTATION CONNECTIONS AND METHOD OF JOINING WITH COLORADO POWER COMPANY'S TRANSMISSION LINES

42-in. feeder spacing allowed. Around each connection between the lower bus shelf and the floor is a Westinghouse type FR current transformer used to operate the tripping coils of the respective circuit breakers. Copper strap is used from the bus to the current transformer, and below this point cable is employed. The frame supporting the instrument transformers and disconnecting switches extends parallel to the bus structure including a few blank cells for future growth, about 100 ft. As mentioned before, the switches and bus connections on the floor above are in line, so that short straight cable runs are obtained.

On each circuit breaker pot is a casting which contains the solenoid closing and tripping mechanism, a switch actuating the pilot lamps, an adjustable dash pot with quick-opening springs and buffers, gas relief

valves and levelling screws. The breaker contacts consist of laminated copper with copper bolt arcing tips and are immersed in oil-filled welded-steel tanks. Control wires in the form of three-wire cable enter each compartment through a conduit. The front row of breakers is connected with the generating bus, while the back row, with the exception of a few generating switches, connects with the Colorado Power Company bus.

All of the three-phase lighting feeder switches have separate-pole or phase control, while the three-phase power feeders and generating lines have all three poles interlocked. Ample room for repairing and inspecting switches is afforded by a 3-ft. aisle between the two rows of compartments. These operations are further facilitated by using the gravity system to fill and drain the oil tanks, a portable truck being employed to carry the oil drums. Supported directly over each circuit breaker and at operating distance from the aisle are the respective disconnecting switches.

Lightning conditions in Colorado are very severe, and a large percentage of the service interruptions are due to lightning troubles, either locally or on the incoming transmission lines. Some idea of the exposure to lightning may be obtained from the fact that the transmission line from which energy is received extends 155 miles over mountains at an altitude of about 13,628 ft. As a ground on this system through a defective lightning arrester would result in a serious short-circuit, the necessity of a high-class type of arrester is obvious. Since the working basis of the new development was not only economy of distribution, but also economy of repairs and continuity of service, all feeders and tie lines are protected with Westinghouse type A electrolytic arresters. There are seventeen of these arresters, with horn gaps, mounted directly behind the circuit breakers on the main floor.

Varnished cambric and asbestos-insulated cables ranging in cross-section from 300,000 to 500,000 circ. mil. are used inside the station for the 4000-volt circuits. The gallery piers support a large portion of the conduit for the control cable, while the lead-covered cable for generator and exciting mains are located in the basement. Due to piping, possible leaks, and elevation, it was not considered advisable to install any electrical apparatus of operating importance in the basement. The new or south end of the station also contains the transformer banks, reciprocating engines, and generators, with turbo-generator auxiliary machines and condensing apparatus.

Distribution

With the new system, the single-phase feeders have been used in pairs to serve as three-phase, four-wire feeders at 4000 volts. The feeders are run to distribution centers, and from these points on single-phase 2300-volt lines, each consisting of one-phase wire and a branch neutral, are provided to feed the service transformers as heretofore. Combining the single-phase feeders into three-phase, four-wire feeders has increased the transmission rating up to center of distribution 33 1-3 per cent with the same line losses as existed before. In other words, the same power may be transmitted with a saving of 33 1-3 per cent in line losses.

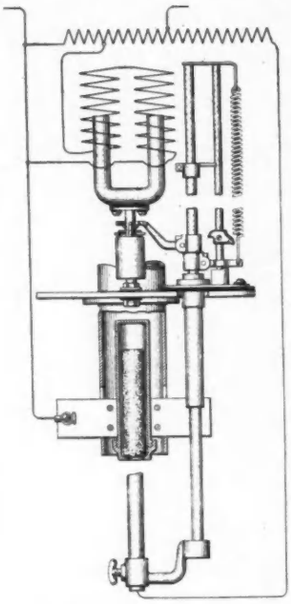
From the center of distribution on there is no saving, as a copper neutral of the same size as the phase wire must be used. However, the losses in the single-phase feeder from the center of distribution are not serious, inasmuch as it is practicable to run transformer feeders of sufficient size to economically take care of the single-phase distribution. Power for operating the motors on the company's line in the city will, in most cases, be supplied at the original 2300-volt, three-phase pressure by means of a 4000/2300-auto-transformer.

Continuous copper neutrals were employed to assure a low and unvarying resistance. This fourth wire, or grounded neutral, is grounded only at the station end to prevent the collection of stray currents. Both power and lighting circuits are connected with the same feeder, since the peaks occur at different times and thus fill up the load valleys, giving more uniform operating conditions. The third harmonic, which is a resultant of this system, is taken care of, as far as parallel generator operation is concerned, by using resistances in the neutral leads from generators to ground.

Practically all of the equipment used in changing over this system was furnished by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa. The installation was made by the engineers of the Denver Gas & Electric Light Company, and the rearrangement of the distribution system was under the direction of R. A. Hammack of the Denver Gas & Electric Light Company. L. Bartlett, electrical engineer for the Doherty Operating Company, made the investigation that led to the change.

Flaming Arc Lamp

Dr. Charles P. Steinmetz in patents Nos. 1,200,257 and 1,200,258 discloses a very simple remedy for overcoming the hitherto troublesome insulating deposit which tends to collect between the electrodes of the titanium arc. In a lamp of the above type, a non-conducting slag is liable to form at the tip of the lower titanium electrode, which, when cold, prevents a proper establishment of the arc unless special provision is made for overcoming this defect. In addition the arc gives off fumes which tend to form a dense insulating deposit, and if allowed to collect upon the upper or carbon electrode further interferes with the establishment of the arc.



TITANIUM ARC LAMP

By controlling the operation of the lamp through a single magnet, the electrodes are thereby brought together with sufficient impact to break through any ordinary insulating slag. At the same time it has become possible to create a large difference of potential between the electrodes, which also tends to break down any slag that may have formed upon the arcing ends of the electrodes

By this method of operation two local sources of low and high potential electrical energy respectively are established inductively by the line current, the low potential energy, acting upon the single magnet, causing the latter to bring the two electrodes in contact. When the contact is effected the local high potential source can discharge its energy through the electrode circuit, so that the electrodes become separated and the arc is maintained by the high potential energy. The earlier patent discloses a means for impressing upon the slag deposit or overvoltage without the mechanical impact.

Calculation of Flow of Steam Through Pipes

A Graphical Solution of the Flow of Saturated and Superheated Steam Through Pipes Based Upon a Formula Derived by George H. Babcock

BY FREDERICK N. HATCH
Member Engineering Staff Westinghouse, Church, Kerr & Company

THE most convenient formula for calculating the flow of steam through pipes is the one proposed by George H. Babcock, as derived from Unwin's formula for friction loss in a pipe and based on Bernoulli's theorem, with proper modifications for variation of constants for steam and water. Babcock's formula is derived in "Steam," published by the Babcock & Wilcox Company. As a result of investigations on this subject, Carpenter states that the expression as given is based on what are probably the most careful and accurate tests ever made on the flow of steam through pipes (Trans. Am. Soc. M. E., Vol. 20). The fact remains, however, that most of the experiments on steam flowing in pipes were made with pipes less than 5 in. in diameter, but it is believed that the Babcock formula may be used in connection with pipes of any diameter with better results than any other formula yet proposed. For convenience of reference, a partial derivation of the formula is given in what follows here.

Let p = pressure drop in pounds per square inch between ends of the pipe,
d = inside diameter of pipe in inches,
D = density of the steam at the mean of initial and terminal pressures,
W = weight of steam passing in pounds per minute,
V = velocity of flow in feet per second,
L = length of pipe in feet,
A = transverse internal area of pipe in square feet,
C = a constant determined from tests.

By developing Unwin's formula to give pressure drop instead of loss of energy due to friction in the pipe, we will have the expression:

$$p = C\left(1 + \frac{3.6}{d}\right)\frac{V^2DL}{6gd},$$

which, by substituting 32.2 for g, the acceleration due to gravity, and using Babcock's value of $C = 0.0027$, becomes:

$$p = 0.000014\left(1 + \frac{3.6}{d}\right)\frac{V^2DL}{d} \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

But $W = 60V\left(\frac{d}{12}\right)^2\frac{\pi D}{4}$ or $W = 60VAD$,

and $V = \frac{9.6W}{\pi d^2D}$ or $V = W/60AD$.

By substituting the first value for V in (1), we get:

$$p = 0.0001307\left(1 + \frac{3.6}{d}\right)\frac{W^2L}{Dd^5} \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

$$\text{and } W = 87.5\left[\frac{pDd^5}{(1 + 3.6/d)L}\right]^{\frac{1}{2}} \quad \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Formulæ (2) and (3) are practically the same as given in "Steam."

Formula (3) may be simplified by writing it in the form: $p = V^2DK$, where $K = \frac{0.000014(1 + 3.6/d)L}{d}$ which, for a fixed length, L, varies only with the pipe diameter. For convenience, in what follows L will be assumed as 100 ft. For any other length the results should be multiplied by $L/100$.

It is a rather slow and tedious operation to solve these expressions directly for the various unknown quantities in any particular case, and the use of a "steam table" is required. To assist in the application of the formulæ, several tables and charts have been worked up and published, but the writer believes that the alignment or nomographic method of charting is better suited to this case than any other type of chart, and such a chart has been developed, as shown in the accompanying illustration. Properly read, this chart will give results well within the limits of error imposed by errors in the original assumptions, and its use will prevent the possibility of making the large errors liable to occur in direct computations. Furthermore, it is entirely self-contained and does not require the use of a table of the properties of steam. This type of chart is more open and consequently more easily read than one of the co-ordinate or logarithmic co-ordinate type, and it has the further advantage that the effect of any variation in any or all of the assumed quantities is readily determined.

The use of the chart will be apparent if the solution of the example given thereon is followed. In this connection it should be noted that the initial absolute pressure may be used for the mean absolute pressure in making a trial solution, and that no correction need be made if the pressure drop is found to be relatively small.

The chart may be used for superheated steam with little additional labor, as the only difference between saturated and superheated steam, as far as the flow is concerned, is in the density, which is less for superheated steam at any given pressure. With errors of less than 2 per cent, the density of superheated steam at absolute pressures between 50 and 200 lb. per square inch for various amounts of superheat is as follows, expressed as a percentage of the density of the steam at saturation:

Superheat, deg. Fahr..	0,	50,	100,	150,	200,	250,	300,	350,	400,	500,	600
Density, per cent.....	100,	92,	85,	80,	76,	72,	68,	65,	62,	57,	53

For any given steam pressure the graduation on the D scale should be nearer the top of the chart if the steam is superheated. To make this correction an auxiliary scale is given on the chart, with directions for making use of it.

There has also been placed on the chart a table of the lengths of pipe to be added to the actual length to obtain the effective length due to the increased resistance through elbows, valves and entrance. A pipe leading from the side of a tee should be considered as having a square entrance. The values in this table were calculated from the formula $L = \frac{114d}{12(1 + 3.6/d)}$, for each square entrance or globe valve. Two-thirds of these values are allowed for each 90-deg. elbow. In the above, L is the equivalent length of straight pipe. This formula is given in the 1913 edition of the Na-

Flow of Steam in Pipes—Saturated or Superheated

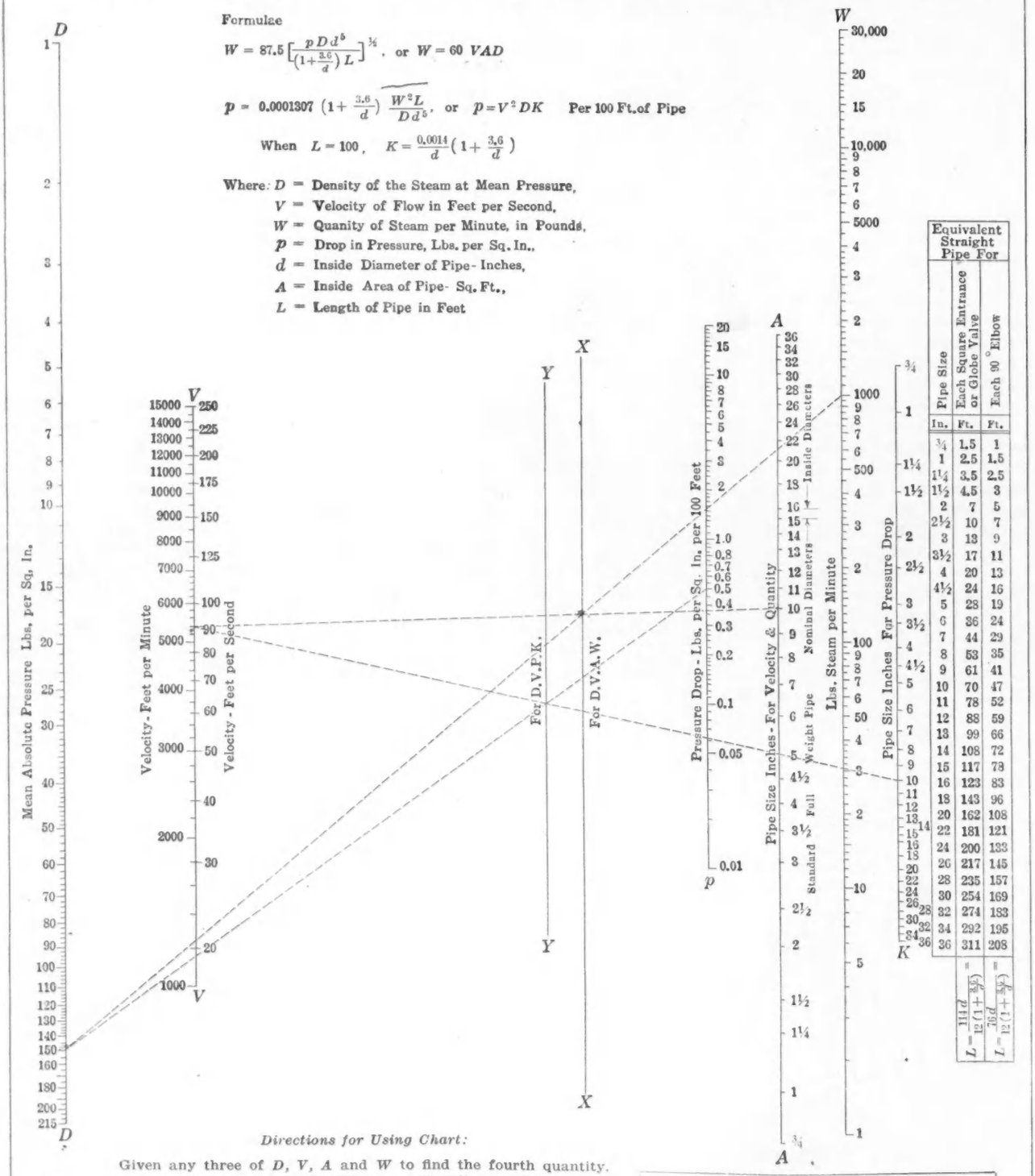
Formulae

$$W = 87.5\left[\frac{p D d^5}{\left(1+\frac{3.6}{d}\right) L}\right]^{\frac{1}{2}}, \text{ or } W = 60\,VAD$$

$$p = 0.0001307\left(1+\frac{3.6}{d}\right)\frac{W^2 L}{D d^5}, \text{ or } p = V^2 DK \quad \text{Per 100 Ft. of Pipe}$$

When $L = 100$, $K = \frac{0.0014}{d}\left(1+\frac{3.6}{d}\right)$

Where: D = Density of the Steam at Mean Pressure,
V = Velocity of Flow in Feet per Second,
W = Quanity of Steam per Minute, in Pounds,
p = Drop in Pressure, Lbs. per Sq. In.,
d = Inside Diameter of Pipe - Inches,
A = Inside Area of Pipe - Sq. Ft.,
L = Length of Pipe in Feet



Pipe Size	Equivalent Straight Pipe For Each Square Entrance or Globe Valve	Equivalent Straight Pipe For Each 90° Elbow
In.	Ft.	Ft.
¾	1.5	1
1	2.5	1.5
1¼	3.5	2.5
1½	4.5	3
2	7	5
2½	10	7
3	13	9
3½	17	11
4	20	13
4½	24	16
5	28	19
6	36	24
7	44	29
8	53	35
9	61	41
10	70	47
11	78	52
12	88	59
13	99	66
14	108	72
15	117	78
16	123	83
18	143	96
20	162	108
22	181	121
24	200	133
26	217	145
28	235	157
30	254	169
32	274	183
34	292	195
36	311	208

$L = \frac{114d}{12\left(1+\frac{3.6}{d}\right)}$ = $L = \frac{76d}{12\left(1+\frac{3.6}{d}\right)}$

Directions for Using Chart:

Given any three of D, V, A and W to find the fourth quantity.
Connect D and W } The connecting lines to intersect
Connect V and A } support X-X in a common point.

Given any three of D, V, p and K to find the fourth quantity.
Connect V and K } The connecting lines to intersect
Connect D and p } support Y-Y in a common point.

Example:

Given—1000 lb. steam per minute at mean absolute pressure of 150 lb. (135.3 lb. gage) through a 10-in. pipe. A velocity of 5400 ft. per minute and a pressure drop of 0.5 lb. per 100 ft. of pipe is found by following the broken lines.

Superheat Correction Degrees Fahr.

To Use Chart For Superheated Steam

For any given superheat, the working point on D scale for any absolute pressure is above the plotted point for that pressure by the length of the superheat correction scale from 0 to the given superheat. This correction must be made before any other operation if D is given; after all operations if D is sought. In the example given, the same results would be obtained with 200 deg. superheat and 200 lb. absolute pressure.

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tional Tube Company's Handbook and in "Mechanical Equipment of Buildings," by Harding and Willard, 1916.

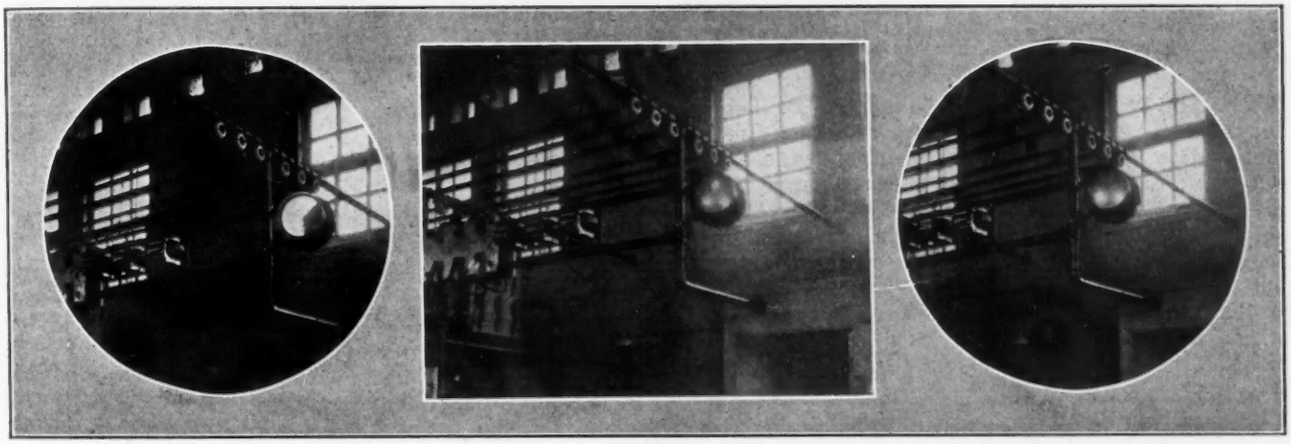
It should be borne in mind that Babcock's formula is based on the assumption that the pipe line is level. If there is any great difference of elevation between the ends of the line, and it seems desirable to take it into account, it would be necessary to correct the results obtained by increasing or decreasing the velocity due to a drop or rise in the line, and by increasing or decreasing the pressure drop between the ends of the line due to a rise or fall in the line. The change in velocity will be $V = [2gH]^{\frac{1}{2}}$ and the change in pressure drop will be $p_1 = \frac{DH}{144}$, where H is the difference of elevation in feet and g is the acceleration due to gravity.

It should also be noted that no account is taken here of the drop in pressure, or other losses, due to loss of heat while the steam is passing through the pipe.

Ground Detector Developed by Pacific Coast Company

Construction and Operation of a Sensitive 2200-Volt Ground Detector That Gives an Audible as Well as a Visible Signal

BY GEORGE E. ARMSTRONG
Department of Generation, Southern California Edison Company



FIGS. 1, 2 AND 3—GROUND DETECTOR AT LOS ANGELES SUBSTATION, SHOWING DIFFERENT-RESISTANCE GROUNDS

Relative illuminations of sectors with less than 10,000-ohm ground (left); appearance of detector with no ground on system (center), and illumination of ground-glass face with 150,000-ohm ground (right).

IN order that operators may be warned of any grounds on the 1200 miles of 2200-volt lines of the Southern California Edison Company as soon as they develop, the writer has devised a ground detector which is more sensitive than the static type and in addition gives an audible as well as a visible signal. While the principles involved are not entirely new, the form of apparatus is considered much better than previously used and application has been made for a patent covering its construction. The outfit includes three Y-connected 2200/122-volt transformers, across the secondaries of which are connected carbon lamps. These lamps are arranged symmetrically inside a cylindrical case with a ground-glass front, and are separated by partitions, as shown in an accompanying illustration. Between the primary neutral and ground is connected a high-resistance telegraph relay with an alarm bell.

OPERATION OF THE DEVICE

When a "ground" occurs on any one of the lines the potential across the transformer connected to that phase will be reduced and the potential of the remaining transformers slightly increased. Coincidentally current will flow from the neutral to ground, and the lamp which is connected across the grounded phase will be dimmed or extinguished, depending on the resistance of the ground, and the other lamps will increase in intensity. At the same time the current flowing from neutral to ground through the telegraph relay will ring the alarm bell. The relay is so connected, however, that its coils are automatically short-circuited directly after transmitting the signal, to protect them against excessive voltages which might occur. To permit adjustments for weather conditions a lever is provided which will change the tension of the relay spring. This is necessary since only 0.002 amp. is required to operate the relay, and this current will flow when a line falls on dry earth, whereas in wet weather grounds which are not all serious would operate the relay. Thus in wet weather it is necessary to maintain a stronger spring tension on the relay armature. Auxiliary switches are provided to remove the lamps and relay from circuit when a ground cannot be removed in short order.

Since the value of the device as a ground indicator depends on the lamps agreeing in candlepower at the same voltage, it is especially necessary to maintain the integrity of the set by replacing lamps that burn out with units of equal candlepower. Ordinary lamps as obtained from the warehouse, however, do not agree closely in candlepower, varying from 9 to 20 cp. Consequently, the Southern California Edison Company specifies that lamps for this purpose be selected in sets of three with a voltage variation not to exceed 0.5 cp.

Results Obtained

With this equipment "grounds" having as high resistance as 500,000 ohms can be detected visually by comparing the lamp intensities. Much higher resistance grounds than can be indicated by the lamps can be detected audibly by the alarm bell operating. Extremely poor grounds, such as a wire lying on dry and painted cement inside a station, have even been

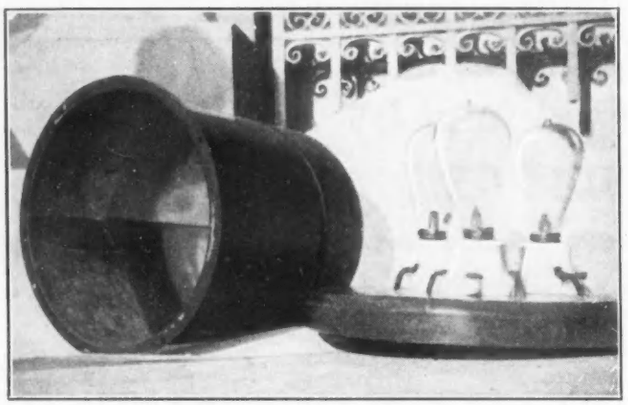


FIG. 4—PARTITIONED CASE AND LAMP SUPPORT MAKING UP GROUND DETECTOR

detected by the device. It may be pointed out that when tungsten lamps were used in place of carbon units the visual detection was not as sensitive, because it required a difference in voltage of almost 6 per cent before a difference in light intensity could be observed. As a result of using these detectors it has been found that some slight grounds which appear during the day disappear in the evening and vice versa. Probably this is due to the expansion and contraction of the line wires, since with the spans used and temperatures existing, the sag may vary from 4 in. to 16 in. between

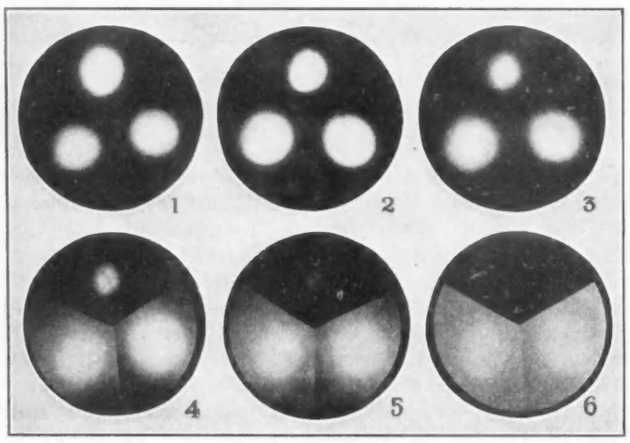


FIG. 5—CHART FURNISHED OPERATORS AS BASIS FOR JUDGING GROUND RESISTANCE

Plate 1—1,000,000 ohms or more resistance; Plate 2—500,000 ohms; Plate 3—250,000 ohms; Plate 4—150,000 ohms; Plate 5—75,000 ohms; Plate 6—Zero resistance. In using this chart the operators record on a log sheet the number of the plate corresponding most closely with the face of the detector in his station. These plates were made under known conditions of grounding, but as the photographic plate has a different sensitivity than the eye, slightly different grounds than those indicated for the above plate were imposed to compensate for this difference.

day and night. To eliminate these periodically occurring grounds considerable tree trimming had to be done. Among the places in which the ground detectors have been installed are Los Angeles, Whittier, Pasadena, Santa Ana, Long Beach and Ocean Park. In each place they have given very satisfactory results, detecting slight grounds that might have developed into serious ones.

In one case Los Angeles substation No. 1 was paralleled with a circuit from another station in which a detector had not yet been installed. Immediately thereon the detector in the first station indicated a ground. This was quickly found to be within the second station, and serious trouble was thereby averted. At another time a low-resistance ground occurred on a defective cable in an iron conduit. If this condition had remained undiscovered, it would undoubtedly have become the source of considerable trouble and expense. As it was, however, the cable was replaced and an interruption which might have been of great length was avoided. In another case a ground was detected upon a certain circuit shortly before noon. As this circuit was quite long and had numerous branches it was anticipated that difficulty would be encountered in locating the ground. However, at noon, the ground cleared itself, and this led to the conclusion that it must have been located upon the premises of some consumer having control of a 2200-volt switch. After referring to a list of the large consumers on that circuit it was thought that the fault might be at a brick-making concern, where a large 2200-volt motor was used to drive a pressed-brick machine. This assumption was confirmed by running the motor. As a result repairs were made

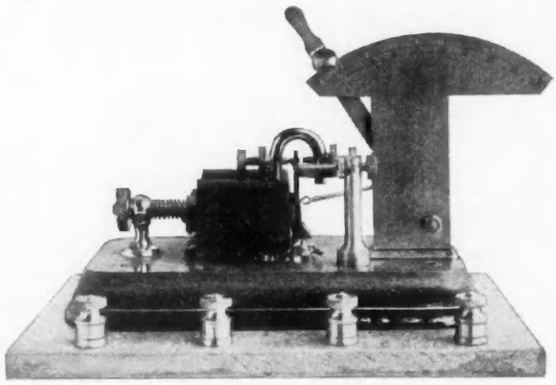


FIG. 6—CONSTRUCTION OF RELAY USED WITH GROUND DETECTOR SHOWING SENSITIVITY ADJUSTER

before the damage was extensive, and thereby avoiding the necessity of shutting down the brick-making machine.

Keeping Records of Ground Indications

To permit making full use of the ground indications report blanks have been furnished the operators in stations where these detectors are installed. On these forms are recorded such items as: Leg grounded, date, hour, weather, and intensity of ground. The latter is judged by comparing the indicator with a set of photographs illustrating relative light intensities under different ground conditions. By means of this report the district foreman is informed of the nature of the ground to hunt for. The data thus collected are compiled and disseminated later to increase the value of the detectors.

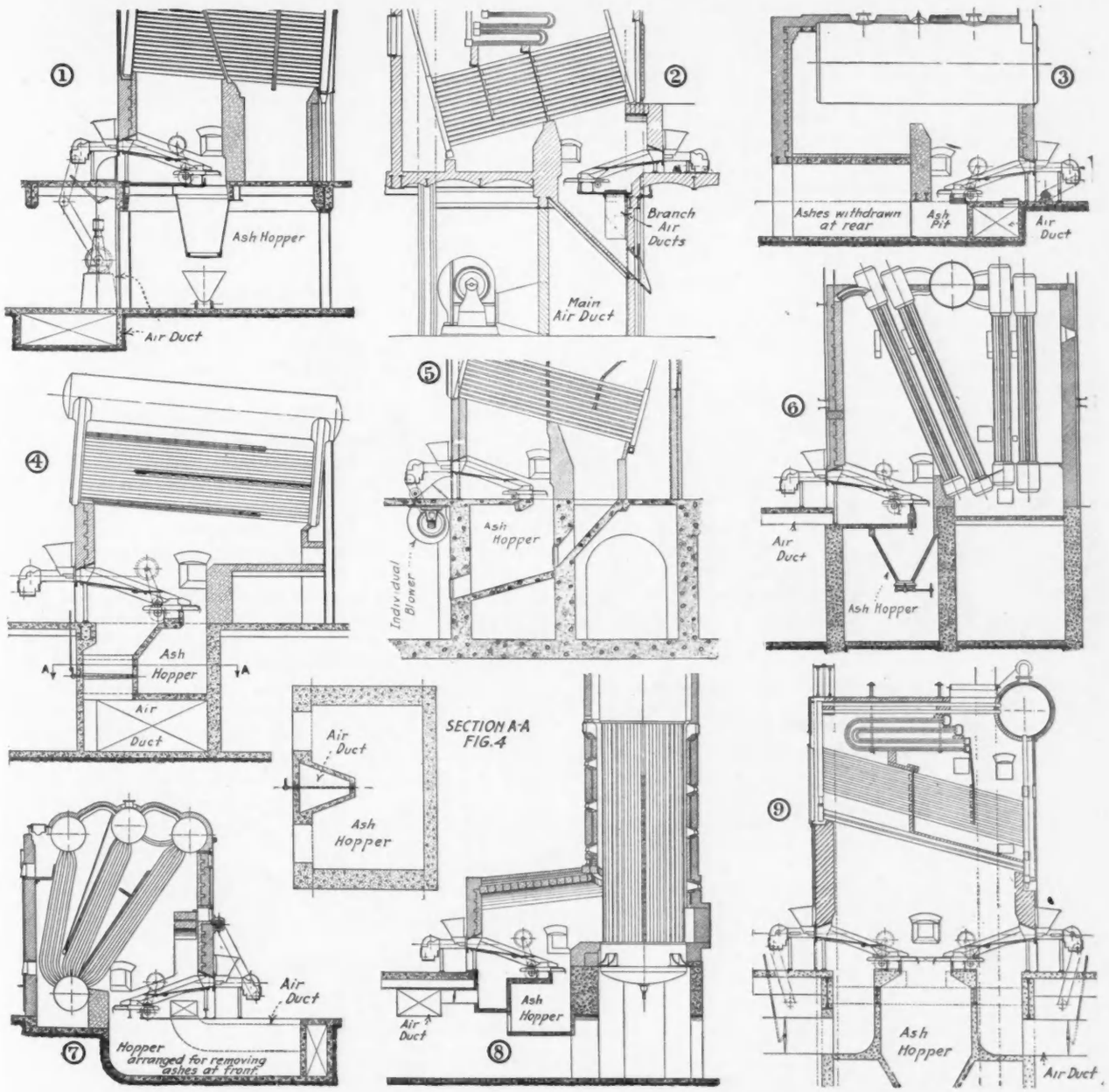
It is of considerable value to know the approximate resistance of a ground because it gives the man looking for the fault an idea of the nature of the ground. For instance, a high-resistance ground occurring in dry weather will indicate that a wire is lying on dry earth, pavement or dry wood, whereas a low-resistance ground in the same kind of weather will indicate that the ground will probably be found in some distributing transformer, primary oil switch or primary motor. A ground which will measure 1,000,000 ohms in dry weather, however, will measure much less in wet weather, so this has to be taken into consideration when efforts are being made to locate the fault.

Boiler Settings Under Different Conditions

Convenient Arrangements for Stoker Drives, Air Ducts, Ash Hoppers, Air Blowers and the Like with Different Types of Boilers and Under Different Conditions

IN those cases where space is restricted for the installation of underfeed stokers practical ways out of many difficulties are shown in the accompanying arrangements suggested by the Sanford Riley Stoker Company. While most of the settings illustrated are for limiting conditions, others are more or less ideal arrangements that can be worked out in new installations. Since the relative positions of stoker drive, forced-draft fans, and ducts can be varied almost at will, only three standard locations have been suggested for the stoker countershaft: (1) Under the stoker cylinders; (2) under the boiler room floor and (3) over the stoker hoppers.

Where there is no basement under the boiler room floor the arrangement of underfeed stokers for a horizontal return-tube boiler may be as shown in Fig. 3. The ashes can then be removed from under the bridgewall and thence under the boiler to the passageway



Boiler Setting Arrangements Suited to Different Conditions

Fig. 1—Method of setting Babcock & Wilcox boilers when open basement is available; Fig. 2—Similar boilers at Port Morris (N. Y.) station of the N. Y. C. R. R. Co., where stokers had to be set low; Fig. 3—Boiler arrangement with no basement; Fig. 4—Air duct passing through ash hopper of Edge Moor boilers at American Printing Company's plant, Fall River, Mass.; Fig. 5—Babcock & Wilcox boilers with individual blowers in municipal plant, Regina, Saskatchewan; Fig. 6—Bigelow-Hornsby boiler setting at Worcester (Mass.) Electric Light Company's plant; Fig. 7—Stirling boiler arranged to permit removing ashes from front; Fig. 8—Wickes boilers at Columbia Mills Company's plant, Minetto, N. Y.; Fig. 9—Double-end fired Babcock & Wilcox boiler at Buffalo General Electric Company, Tonawanda, N. Y. A similar arrangement is provided for the Stirling boilers of the Detroit Edison Company.

behind the boilers. This arrangement requires the minimum of excavation and the progress of the fuel is continuous from the front to the rear of the boiler. It also keeps the stoker drive shaft away from the destructive action of the ashes. A modification of this arrangement would be to take the ashes out under the side wall of the boiler. The stoker countershaft can be conveniently located under the cylinders as shown, or it may be set in a trench to avoid the necessity of a ramp or step over the shaft where it crosses the aisles between boilers. The air duct may be located in front of the boiler setting, if inconvenient elsewhere.

With a Stirling boiler and no basement, and where conditions require the removal of ashes from the front, the setting may be arranged as shown in Fig. 7. While operators generally do not like to remove ashes this way, it may be pointed out that considerable clear space is afforded under the stoker with this arrangement. Furthermore there are no moving parts nor obstructions due to air pipes, because the air ducts are built into the foundation side walls. In this case the stoker countershaft is shown above the stoker. Since the driving chains do not "hug" the boiler front, the front doors at each end of stoker hopper are easily accessible.

Where an open basement is available under Babcock & Wilcox boilers the stoker driving connection, fans, air ducts and ash disposal equipment may be installed in some such position as shown in Fig. 1 and connected with the stoker wind box by direct ducts with few turns. This arrangement of stoker-driving countershaft is a common one. If preferred the ducts could run directly up underneath the stoker instead of discharging into the front as shown. The stoker-driving engine might be above boiler floor.

Sometimes space limitation prevents setting a boiler high or too much expense would be involved by changing it. In this case the stoker can be arranged as shown in Fig. 2. In the installation represented the bridge wall and ash hopper construction were retained intact, hence the necessity for moving the front wall out. The short arch shown is not required for combustion, and is provided simply to fill in brick work under the boiler header. Higher settings are recommended for boilers equipped with underfeed stokers but this shows what can be done under such limiting conditions. The gear boxes are close to the floor, yet there is room for the countershaft under the cylinders. Attention is called to the utilization of space under the ash hoppers as a continuous air duct.

In very shallow basements the air duct and branch connection to stoker wind boxes can be arranged as indicated in Fig. 4. Ample ash storage is permitted on top of the main duct and the latter does not interfere with head room. The triangular shaped duct, connecting the main duct with the stoker wind box, allows easy access to the ash pit for raking out its contents. If it is undesirable to handle the ashes as shown, the ash hopper may be easily modified to permit removing its contents from underneath the rear of the boiler. Otherwise this space may be used for fan location. This is especially desirable when hot air from the ventilating fans of the main turbo-generator can be discharged there, as it permits utilizing preheated air.

A more or less ideal setting with the ash hopper discharging downward, is shown in Fig. 6. The ashes are confined to the passage shown, and are thus kept away from the fans and stoker-drive shafting, which may be properly located in the basement under the firing aisle. The arrangement of dropping the floor level under the stoker proper allows simple air ducts to discharge horizontally without any turns.

Although a Dutch oven is not required for combustion purposes with the type of underfeed stoker represented, the ash hopper, stoker drive and air chamber under the stoker can be arranged very conveniently when this construction is used. As shown in Fig. 8 the connections between the wind box and main air duct can be made very short and direct and ashes can be removed from the hoppers very easily.

When individual fans are used with each boiler they may be installed as shown in Fig. 5 and driven by the same engine or motor that operates the stoker. Under such conditions no air ducts are required and less power is required for driving. The main line shaft is located above the floor and driven by a machine at one end of the boiler room. Between this shaft and the stoker roller-chain transmission is used, while silent-chain drive is employed for the fan connection. Instead of a continuous shaft an engine might be installed for each fan and stoker.

Stokers may be installed under each end of a boiler as shown in Fig. 9 when excessively large steaming capacity is required in small space. With this arrangement ashes are discharged between stokers into the same hopper and no bridge wall is required to which clinkers may adhere.

CONVERTING PIN-TYPE TO SUSPENSION-TYPE LINE

How the Southern California Edison Company Changed Insulators On Its Kern River Transmission Line Without Interrupting Service

BY GEORGE H. STOCKBRIDGE

Superintendent of Transmission of the Southern California Edison Company

Owing to interruptions caused by birds alighting on its transmission lines or building their nests in guards over the insulators, the Southern California Edison Company had to change its Kern River line across Bakersfield plains from pin-type insulator to suspension-type insulator supports. To provide sufficient clearance between the bottom arm and the wire hanging from the top arm, it was found necessary to lower the bottom arm 2.5 ft. Since this change made it necessary to support the bottom wires 4.5 ft. lower, the clearance from ground was so reduced that it was necessary to raise the towers. The only way this could be done without interrupting service was to raise the towers bodily and insert a section at the ground line, resetting the stub and foot plates to conform to the dimensions of the new base.

To permit doing this, use was made of gallows frames made of 6-in. by 6-in. timbers put together in such a way that they could be quickly knocked down into four pieces by removing a few machine bolts. These frames were arranged to support a 2-ton duplex chain block at each corner directly over the leg of the tower. Platforms were provided at each corner of the frame so men in contact with the tower while it was being raised would not be in contact with the ground in case an insulator broke on one of the live lines. Copper cables were clamped to the towers and to the foot plates while the tower was being raised. The pin insulators and tie-clamps were depended on to steady the towers in the direction of the line, and stranded steel side guys running back to anchors 120 ft. each side of the line were used to hold the towers upright during these operations. Differential chain blocks were inserted between the side guys and the anchors so that the guys could be "slacked off" when the towers were raised and still keep the towers from overturning.

The first step toward raising the tower was to dig down outside each tower leg sufficient to allow the leg

and foot plate to be moved back 12 in., and also provide room for the derrick leg which was set at the bottom of the hole. In ordinary soil the area of the derrick leg was sufficient to support the load amounting to about 3½ tons. In loose soils, however, additional plank footings were provided under each derrick leg to increase the bearing value. With this arrangement a

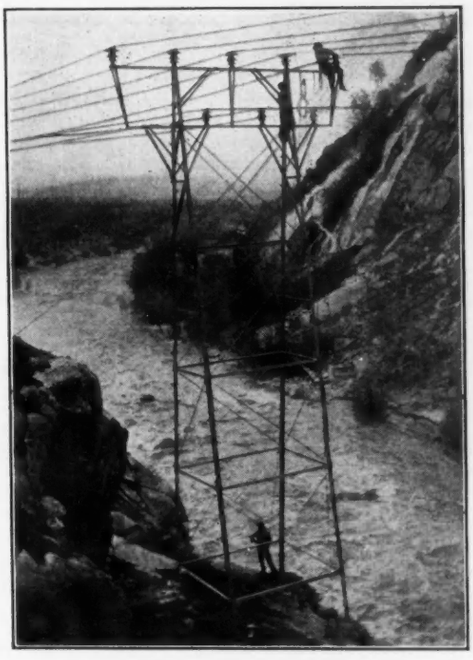


FIG. 1—ONE OF THE KERN RIVER TOWERS BEFORE CONVERSION TO SUSPENSION-TYPE INSULATION

crew of ten men raised an average of two towers a day without interrupting service and without trouble.

As soon as the sections on each side of the camp were raised as far as it was economical to go, the work of lowering the arms and changing the insulators was

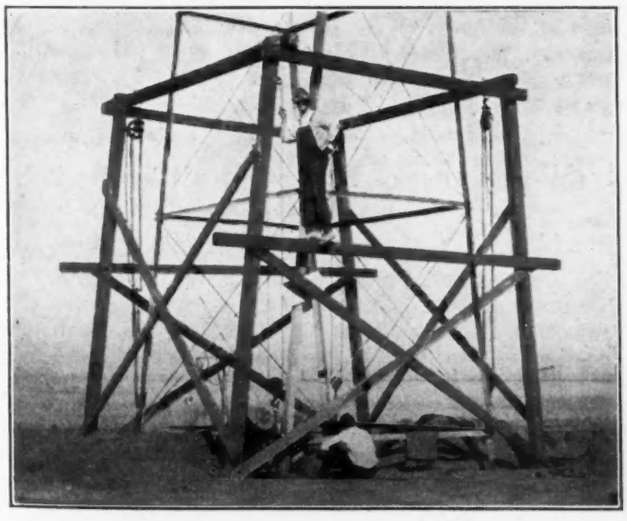


FIG. 2—TOWER-RAISING EQUIPMENT USED IN ADDING 10-FT. SECTIONS

undertaken. There being two circuits on each tower, it was possible to do this work without interrupting the service, but the frequent changing from one line to the other required endless vigilance on the part of the field men and switching attendants to prevent serious accidents. In preparing for this work one circuit at a time was ordered "out" and grounded through grounding switches at each end of the line. In addition, the line to be worked upon had to be grounded at the particular tower being raised. On securing a dead line, the diagonal braces on the top arm were taken off and turned outward and the end braces removed altogether. The wire or wires on the bottom arm were then taken off the pin insulators and suspended from the top arm with four suspension units. After a mile or so of line had been attended to in this manner the switchboard operators were asked to de-energize the other line, when similar changes were to be carried out on the opposite side of the tower.

With this done, the bottom crossarm was removed and lowered, and holes punched in the tower legs at a lower level to receive the new crossarm rivets. Twelve 0.75-in. holes had to be punched on each tower, this being done with boiler-maker's punches set by men on the towers, but operated by men on the ground through the medium of a rope and bar. After the bottom arm was lowered, it was necessary to use a gin pole and set of blocks to change the wires from the top arm to their proper position under the arm, each wire weighing approximately 400 lb. at the tower. These gin poles were 4-in. by 4-in. timber equipped with chains and toggles to avoid unnecessary work and delay in attaching to the arms.

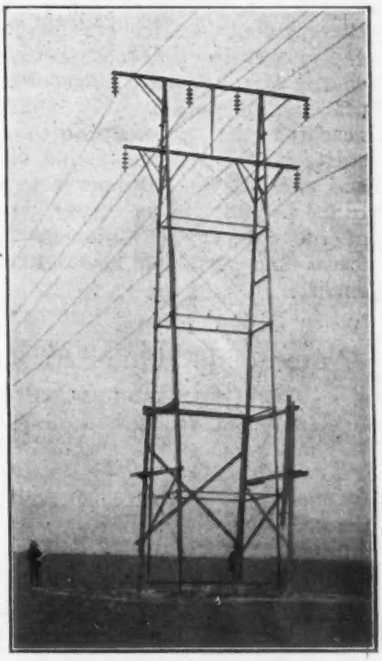


FIG. 3—TOWER CONVERTED FROM PIN-TYPE TO SUSPENSION-TYPE INSULATION

Later, due to the excessive cost of renewing pin insulators on the remainder of the line, it was decided to install suspension-type insulators along the entire route. Owing to the rough and mountainous country through which the remainder of the line ran, the work of changing from pin-type to suspension-type supports was much more difficult than on the Bakersfield plains, but the change was accomplished without an interruption to service or any serious accidents. The work was carried on practically as described heretofore.

In the open sections where it was possible to use a wagon for transportation, the cost of making 10-ft. extension to the towers was about as follows: Material, $32; labor, $17.50; transportation, $5; total, $54.50. In the mountainous districts, however, this cost was as high as $70 per tower for labor and $10 for transportation. The tower-raising crew consisted of ten men, including a foreman and a cook. Two foremen, four linemen, four ground men, a teamster and a cook were employed in remodeling the tops of the towers and changing the insulators. This crew could change two dead-end towers or four straight line towers in one day. The total cost of converting the straight line towers on the plains averaged $52 per tower for labor and materials. Through the mountains, where about one-third of the towers were of the dead-end type, labor and material cost about $85.60.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Division of Losses Between Power House and Customer's Meter

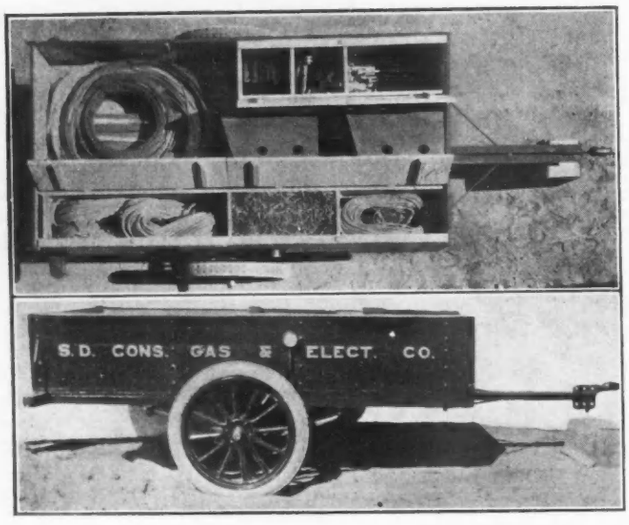
The loss of energy which occurs between the power house and customers' meters ranges from 15 to 20 per cent of the output for a large Middle West system, and is computed in five separate parts. The first part of this loss occurs in the transmission of the energy from the power house to the substations and other distributing points, and amounts to about 7.7 per cent of the output. In the conversion of the alternating to direct current about 4.4 per cent of the output is lost. Storage loss or the difference between the charge and discharge of the storage batteries amounts to only 0.1 per cent of the output. The final loss of energy before reaching the customer is in the distribution which starts at the substation and other distributing points and ends at the customer's meter. This loss amounts to 5.8 per cent. The energy consumed in the operation of the company's equipment is also included in the losses and equal to about 1.2 per cent of the total amount.

Automobile Trailer for Line-Repair Work

BY L. M. KLAUBER

Superintendent Electric Department, San Diego Consolidated Gas & Electric Company.

Two-wheel trailers which carry all materials required for making line repairs are being used by the San Diego Consolidated Gas & Electric Company so that any line difficulty may be attended to without the delay usually caused by waiting for an available construction truck.



SIDE AND TOP VIEW OF AUTOMOBILE TRAILER USED FOR LINE CONSTRUCTION WORK

Each of these material carts is equipped with pneumatic-tire wheels and a coupling by which the drawbar may be attached to the rear of any one of the company's thirty-five automobiles.

One of these trailers is always kept at the store yard fully loaded and ready for instant use. When a line crew is not available for an emergency call, odd linemen can be picked up from various jobs in any company automobile drawing a trailer. The following materials are carried in the trailer:

Material	No. of Items
Crossarms, 6-pin, 11,000-volt, with hardware	2
Crossarms, 6-pin Standard, with hardware	2
Pins, steel (11,000-volt)	6
Pins, locust	12
Insulators, glass (D. G. D. P.)	12
Insulators, porcelain strain, No. 506	6
Insulators, 11,000-volt	6
Wire, galvanized guy wire (0.25-in.)	55 lb.
Wire, bare copper (No. 2)	52 lb.
Wire, bare copper (No. 4)	38 lb.
Wire, weatherproof (No. 6)	37 lb.
Cut-out boxes (complete), 11,000-volt	2
Fuse equipment.	
Holders (11,000-volt)	2
Fuses (22,000-volt, 15-amp.)	3
Boxes (primary 2300-volt)	2
Plugs (primary 2300-volt)	2
Kit:	
Including 11,000-volt fuses in 2, 3, 5, 8, 10, 12, 15, 20 and 25-amp. sizes, and 2300-volt fuses in 1, 3, 5, 10, 15, 20, 25 and 30-amp sizes. Ten of each size of fuse and one wooden fuse puller are provided.	1
Brackets (oak)	6
Splicing sleeves (seamless), No. 6	6
Bracket sleeves (seamless) No. 4	6
Bracket sleeves (seamless), No. 2	6
Dead ends (complete), 11,000-volt	2
Dead ends (complete), 2300-volt	3

Material	No. of Items
Clamps, 11,000-volt brass	21
Clamps, three-bolt guy	4
Clamps, Havens	3
Bolts (galvanized space bolts), ⅝x16 in.	4
Bolts (galvanized space bolts), ⅝x18 in.	4
Bolts (galvanized space bolts), ⅝x20 in.	4
Bolts (galvanized machine), ⅝x 14 in.	2
Bolts (galvanized machine), ⅝x 16 in.	2
Bolts (galvanized machine), ⅝x 18 in.	2
Bolts (galvanized machine), ⅝x 20 in.	2
Screws (galvanized lag screws), 0.5 in.x3.5 in.	12
Pole collars	4
Tackle (4-in. wood block and 200 ft. 0.5-in. rope)	1 set
Tackle (4-in. wood block and 225 ft. 0.5-in. rope)	1 set
Tools:	
Splicing set	1
Braces (12-in.)	2
Wood bits (⅝ in.)	2
Wood bits (1¼-in.)	2
Hand saw (26-in.)	1
Coes wrench (10-in.)	1
Hurd's hand axe (linemen's)	1
Clamp operating handle (11,000-volt)	1
Miscellaneous:	
Nails (20d. common wire type)	2 lb.
Tape (P & B)	1 lb.
Solder (0.5x0.5 strip)	2 lb.
Soldering paste (Burnley's)	1 box
Blow torch (C & L No. 31)	1

As shown by the top view of one of these carts, most of the material is stored in compartments along each side of the body. Wire, crossarms and fuse and cut-out boxes, however, are laid in the open space between. The net weight of the material listed is 720 lb., making the gross weight of the loaded trailer 1337 lb.

Construction of Home-Made Line Switch

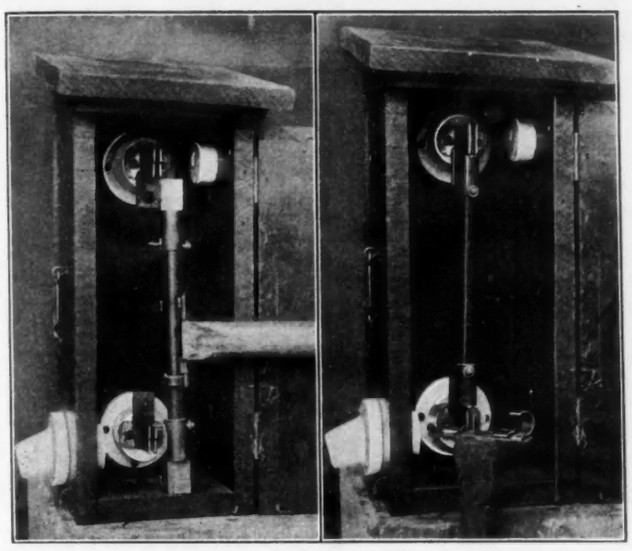
BY N. M. LONGBOTHUM

Installed at numerous places on the 6600-volt lines of the Connecticut Power Company in the vicinity of Thomaston, Conn., are fused line switches of the construction shown in Figs. 1 and 2. The wooden case measures 20 in. by 8 in. by 8 in. and is ventilated by a hole in the bottom. On opposite sides at the top and bottom of the case are extra heavy porcelain bushings which are designed to prevent moisture running into the case along the wires. Fastened to the back of the case opposite each inlet bushing is a porcelain base to which is attached a jaw from a 200-amp. switch. A fiber tube capped with brass sleeves in which have been riveted knife-blade contacts is used for connecting the switch jaws. The fiber tube is 11 in. long, 0.5 in. in diameter (internal) and has ⅛-in. walls. Through the tube and the sleeves, which are 2 in. long, pass 0.25-in. brass binding screws that serve to hold the fuse wire inclosed by the tube.

In order that the switch can be opened when the line is energized without endangering the operator, a special switch stick has also been made. As shown in Figs. 1

and 2 it consists of a 28-in. wood handle with two fingers on the end. Springs are attached to the switch head next to each finger so that when the line-switch tube is gripped it will not slip out of the pole fingers.

One method of connecting these switches in a circuit is to mount them on the cross arm carrying the cir-



FIGS. 1 AND 2—LINE-SWITCH CONNECTOR GRIPPED IN SWITCH STICK (AT LEFT) AND SWITCH CLOSED WITH SWITCH STICK HEAD SHOWN IN FOREGROUND (AT RIGHT)

cuit. Each conductor is then dead-ended on each side of the crossarm insulator with strain insulators and the portion of the line on the side on which the line switch is installed then connected with the upper jaw of the switch. From the lower jaw a jumper drops to an insulator on a lower crossarm and thence connects with the other portion of the sectionalized conductor.

2200 Volts Versus 13,200 Volts for Rural Extensions

Tabulated herewith are the overhead charges which may be assessed on isolated transformers when they are energized all the time. The first group of figures relates to 13,200-volt equipment and the second to 2200-volt apparatus. These data indicate that if rural communities are not far from cities having electric service it may be cheaper to operate and maintain 2200-volt extensions to the city primary circuits than to operate a 13,200-volt line and corresponding voltage transformers. For instance, the overhead charges on a 5-kw. 2200-volt transformer is over $26 less than for a similar size 13,200-volt transformer with the necessary protective apparatus. Assuming interest at 7 per cent, and line depreciation, operation, maintenance and taxes at 6 per cent, the saving on each 5-kw. transformer is sufficient to cover the overhead charges of a 2200-volt line costing $200.

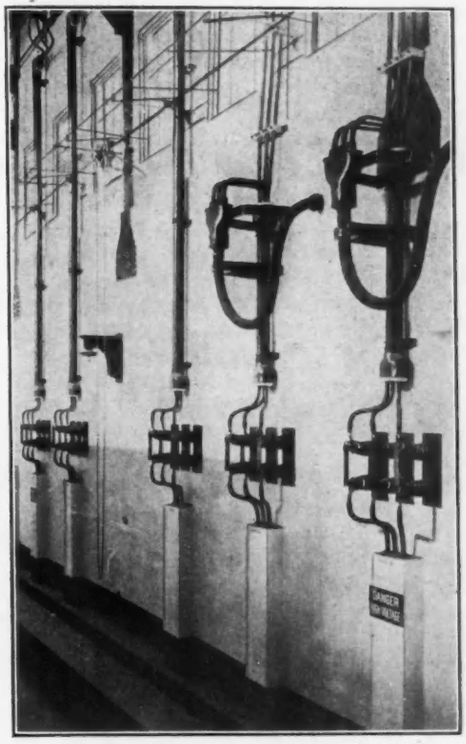
This seems to indicate that for every 5-kw. transformer to be connected the 2200-volt transmission line can cost $200 more than a 13,200-volt line would to serve the same load with the same line loss, without making the overhead charge greater than for the higher voltage line. In other words, if the single-phase 13,200-volt line required to serve a scattered rural load of five 5-kw. transformers costs $7,600, a 2200-volt line having no greater overhead charge would cost $8,600. If the 2200-volt line could not be built for this amount without obtaining a larger line loss than on the 13,200-volt line, then the higher voltage transmission would be preferable.

TRANSFORMER OVERHEAD CHARGES WHEN RURAL DISTRICTS ARE SERVED FROM ISOLATED TRANSFORMERS

13,200-Volt Line		
Cost of 5-kw. transformer installed, including high-tension fuses and horn-gap arrester	$125.00	
Interest, repairs and depreciation, 20 per cent		$25.00
Core loss, 91 watts or 800 kw.-hr. per annum at 2 cents		16.00
Labor for trouble calls		9.00
Total extra cost of service per annum		$50.00
Total extra cost of service per month		4.16
Cost of 3-kw. transformer, installed, including high-tension fuses and horn-gap arresters	$100.00	
Interest, repairs and depreciation, 20 per cent		$20.00
Core loss, 53.5 watts or 470 kw.-hr. per annum at 2 cents		9.40
Labor for trouble calls		8.60
Total extra cost of service per annum		$38.00
Total extra cost of service per month		3.16
2200-Volt Line Extended from City Limits		
Cost of 1-kw. transformer, installed	$30.00	
Interest, repairs and depreciation		$6.00
Core loss, 20 watts or 175 kw.-hr. per annum at 2 cents		3.50
Labor for trouble calls and service		3.50
Total extra cost of service per annum		$13.00
Total extra cost of service per month		1.08
Cost of 3-kw. transformer	$45.00	
Interest, repairs and depreciation		$9.00
Core loss, 35 watts or 307 kw.-hr. per annum at 2 cents		6.14
Labor for trouble and service		3.50
Total extra cost of service per annum		$18.64
Total extra cost of service per month		1.55
Cost of 5-kw. transformer	$60.00	
Interest, repairs and depreciation, 20 per cent		$12.00
Core loss, 45.5 watts or 400 kw.-hr. per annum at 2 cents		8.00
Labor for trouble and service		3.50
Total extra cost of service per annum		$23.50
Total extra cost of service per month		1.96

Submarine Cable Connection in a Hydroelectric Plant

At the Montague City (Mass.) generating plant of the Turners Falls Power & Electric Company, a noteworthy feature of the wiring is the installation of two



TERMINAL FOR SUBMARINE CABLE IN STATION OF TURNERS FALLS POWER AND ELECTRIC COMPANY

13,200-volt tie lines connecting the station with the plant of the Greenfield Electric Light Company. The leads, as shown in the accompanying illustration, are brought out from the plant buses and oil switches into the open as vertical risers, and connected to the terminals of disconnecting switches mounted on insulating

studs carried on the switch-house wall. The risers are run in iron conduit from the line side of the disconnects to a condulet, just above which taps are made through a submarine cable terminal connecting with a three-phase submarine cable which is run out of the building and cross the bed of the Connecticut River to the opposite shore, where an underground line continues to the Greenfield station.

The cable, pothead and conduit are supported on iron clamps as shown, and by carrying the riser upward, direct connections are made to the lightning arresters, which are installed in specially designed roof houses. At the left in the illustration is shown a group of 13,200-volt overhead tie lines connecting the plant with an older station of the company in Turners Falls.

Arrangements to Save the Heat in Gas Engine Cooling Water

BY T. B. HYDE

There are a number of small power plants throughout the country in which both gas and steam engines are used, and still others where gas engines are used for power with steam required for other purposes. In the accompanying diagrams, Figs. 1 and 2, two methods are shown which have been used for making gas engine cooling water available for boiler feed makeup without loss of heat to the system.

A gas engine requires for cooling purposes in the neighborhood of 60 lb. of water per hour per delivered horsepower, depending upon the temperatures of injection and discharge. In order to keep down water bills it is customary to return this water to a cistern through cooling devices such as spray nozzles, cooling racks and the like. Where steam boilers are operated in the same plant, the boiler feed makeup is often taken into the feed water heater direct from the city or service mains or from the cistern.

The gas engine cooling water is usually discharged from the engine at a temperature of 125 to 135 deg.

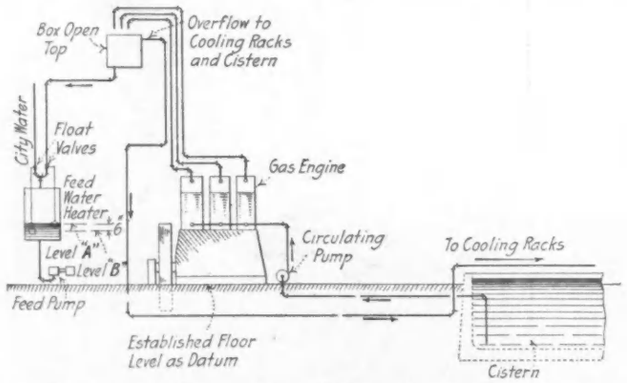


FIG. 1—ARRANGEMENTS TO USE GAS ENGINE COOLING WATER FOR BOILER FEED

Fahr., while its temperature in the cistern, after cooling, will be in the neighborhood of 70 to 85 deg. Water from city mains averages about 50 deg. Fahr. Thus each pound of gas engine discharge water used in the feed water heater represents a saving of 60 B.t.u. over cistern water and 80 B.t.u. over city water. It should be remembered that each 10 deg. saved in this manner represents a saving of 1 per cent in the fuel required to heat and evaporate the quantity of water affected. A further, and by no means insignificant advantage in some cases, is that the cold makeup water for the system, as a whole, is introduced into the cistern, thereby giving the gas engines cooler injection water.

In Fig. 1 the gas engine discharge is piped to an open tank or box, elevated above the engine and replacing the conventional funnel. The feed water heater takes its makeup from a line out of the bottom of this box, the quantity of water being controlled by a float valve at the heater. This box is further provided with an overflow which leads to the sprays or other cooling device at the cistern or pond. To provide against stoppage

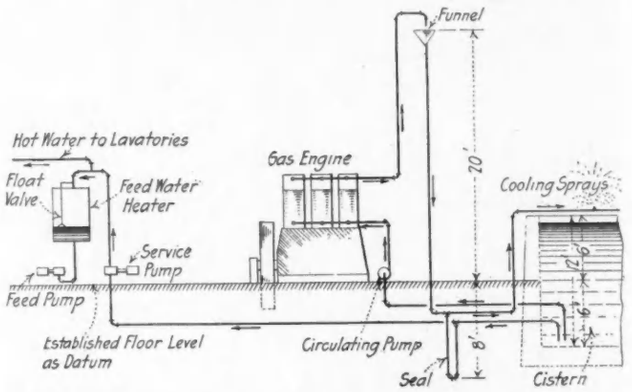


FIG. 2—PIPING ARRANGEMENTS TO USE TREATED WATER FOR GAS ENGINE COOLING AND BOILER FEED

of the gas engine circulating pump, the heater should be provided with another float valve which will admit city or service water to the heater, but this float should be set to operate at a lower water level in the heater. Thus the heater will receive hot gas engine water for all the makeup required, when the same is available. When there is no water available from the gas engines the heater will automatically be supplied with city water.

Another arrangement is shown in Fig. 2, which the writer has employed where the water supply, on account of its hardness, could not be used in the raw state for either gas engine cooling or for boiler feed. A water softening plant discharges directly into the cistern, which also acts as a storage for softened water. In this case the gas engine discharge line runs from its open funnel discharge back to the spray nozzles at the cistern, the funnel being high enough to provide head for spraying the water. The cistern is 12 ft. deep, its top being 6 ft. above and its bottom 6 ft. below grade. The feed water heater takes its supply from a steam driven service pump whose suction is connected to the cistern. Were the system operated as described thus far, we would have the aforementioned waste of heat, viz., cooling gas engine discharge water from 130 deg. to 80 deg. before admitting it to the feed water heater. The gas engine discharge line and the service pump suction line are, however, cross-connected and in this connecting line is installed a loop or "inverted siphon" as shown, extending 8 ft. below grade or 2 ft. below the bottom of the cistern. There is, of course, a foot valve on the service pump suction line in the cistern.

The operation is as follows: When the gas engines are running, the service pump receives its supply direct from the gas engine discharge line due to the fact that this water is offered at a greater head or pressure than cistern water. When the gas engines are shut down, the service pump automatically takes cistern water, the inverted siphon maintaining a seal against admission of air to the pump suction.

Both of the above arrangements are in use and have resulted in marked reduction of the amount of steam supplied the heater to bring feed water up to a proper temperature. Actual figures in one instance showed an increase in the temperature of the water entering the heater which varies from 75 deg. Fahr. to 132 deg. Fahr.

COMMERCIAL AND BUSINESS POLICY

A Department of Plans and Methods for Widening the Application of Electricity and for Extending Electric Service

The Accountant as the Manager's First Lieutenant

"In the United States, at least, the profession of engineering has developed if not devised the present type of management governing the majority of our public-utility companies," said F. G. Whitney in an address before central station men at Tampa, Fla.

"This is probably due in a great measure," continued Mr. Whitney, "to the fact that by reason of the newness of the electrical industry it has not entirely evolved from the construction stage, in which it was reasoned that an engineer must be much in evidence. The industry is developing now so rapidly that it can hardly be said to have yet passed the construction period. Modern ideas of management, however, are also evolving and attempting to keep pace with our industry,"

Mr. Whitney made a plea to engineers for recognition of the accountant's calling as a serious profession attempting to attain somewhat the same results though perhaps through different means—a plea to accountants to prepare, to believe in their profession, to be broad-minded enough to drop their precise, narrow viewpoint, if narrow it be.

"Accounting," said Mr. Whitney, "deserves a place of great importance in management; the accountant is a first lieutenant of the manager."

Flood-Lighting the Skating Pond

During the months of last winter the public skating rink on the lake in Central Park at Schenectady, N. Y., was illuminated with flood-lighting projectors so this popular sport could be enjoyed during the evening.

The projectors were placed on the balcony of the Casino, and lighted both the skating park and the toboggan slide in the background. A 500-watt "Mazda" lamp was used as the light source in each projector.

STREET LIGHTING REVENUES IN NEW ENGLAND DISTRICT

Increase in Revenue Effected Despite Improved Efficiency of Illuminants—Tabular Analyses of Street Lighting Practice in 110 Cities

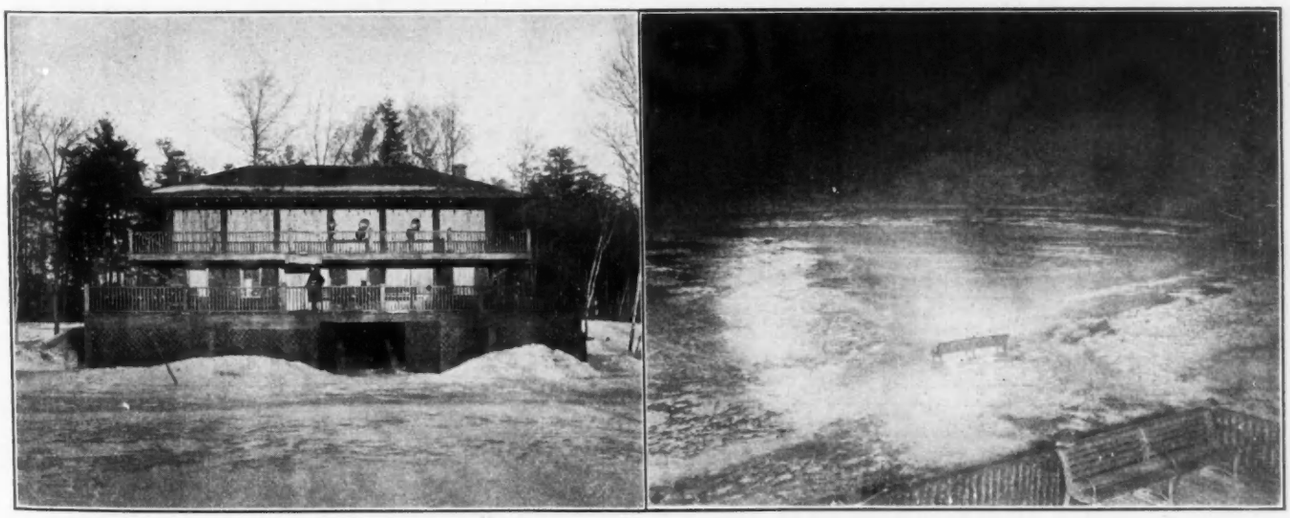
Increased efficiency of illuminants is tending toward better street lighting in New England, according to the paper on that subject read at the recent convention of the New England section of the N. E. L. A. in Pittsfield, Mass., by John West, of C. H. Tenney & Company, Boston. Analyzing the effect of the gas-filled tungsten lamp upon public lighting, Mr. West noted that in the past eight years street lighting revenues in Massachusetts alone have increased 33 per cent, although with the expansion of other service, the ratio of street lighting income to total central station income has fallen from 18.9 per cent to 14.7 per cent.

SUMMARY OF FORMER AND PRESENT ELECTRIC STREET LIGHTING IN 110 TYPICAL NEW ENGLAND CITIES

Lamp	Total Former	Per Cent	Total Present	Per Cent
Carbon arcs	13,831	18	4,553	5
Magnetite and flame arcs	9,900	13	17,996	19
Mazda "C" lamps, 250 cp. and over	....	....	5,861	6
Total large lamps	23,731	31	28,420	30
Mazda lamps, below 250 cp	52,985	69	65,629	70
Total arcs and incandescents	76,716	100	94,039	100

Revenue from arc lighting in 1908 was $1,479,422 and $1,387,566 in 1915; income from incandescent street lights was $488,582 in 1908 and $1,228,995 in 1915. In the face of a marked increase in the efficiency of illuminants, the actual revenue has increased, indicating that the municipalities appreciate the opportunity to secure better and increased illumination for a given expenditure.

While it seems natural to expect that, when consid-



BATTERY OF 500-WATT FLOOD LAMPS INSTALLED IN SCHENECTADY (N. Y.) PARK TO LIGHT SKATING RINK AND TOBOGGAN SLIDE FOR NIGHT SPORTS

ered in the relation of percentage to total income, street lighting revenues will continue to slightly decrease, on account of the fact that domestic and industrial applications of electricity have not even approached the saturation point, the nature of this class of business requires a relatively long-term contract. The independence of street lighting from conditions affecting incomes from other sources makes this business of material importance to central stations, and the tendency of street lighting revenue is to increase. To take advantage of the gas-filled lamp, the old carbon inclosed-arc lamps in the intermediate zone between the business district and the residential area should be discarded, using an increased illumination in the zone bordering on the business section and tapering off into a smaller lamp as the outlying districts are approached. The same wattage might be provided in the outlying districts as before, advantage being taken of the increased illumination obtained with the new equipment. At present few cities are provided with adequate illumination.

Rate Reductions Not Justified in Street Lighting

Consideration of the cost of serving a community with street lights reveals practically nothing to justify a rate of reduction. Street lighting is peculiarly distinct as a part of a company's business; it invariably precedes other business into undeveloped territory, and still maintains itself on the peak load. The energy cost of supplying street illumination is a relatively small part of the total cost of generation and economies in the latter do not weigh heavily in the street lighting total cost, while, as the efficiency of illuminants increases, that proportion for the total cost of energy decreases. The entire street lighting system, beginning at the busbar, is available for public street lighting only, with no opportunity for saturating the investment required with energy sold for other uses, to bring about a rate reduction, as has been made possible in other lines of business. Labor and material costs do not justify reductions in the rates for this class of service. The expense incurred by municipalities in employing experts to secure reductions in street lighting rates is seldom warranted.

Discussion

S. C. Rogers, Lynn, Mass., presented the accompanying tabular analyses of street lighting practice in 110 New England cities and in Massachusetts.

He pointed out that the number of luminous-arc lamps in use is increasing rapidly. It is noteworthy that the kilowatts of street lighting equipment installed per mile of street is 100 times as great in Boston as in the small towns, whereas the kilowatts consumed in street lamps per 1000 population varies only two to one and bears no definite relation to the size of the municipality. The present number of carbon-arc lamps is only one-third that of a few years ago, while the number of magnetite lamps has nearly doubled, the number of tungsten lamps below 250 cp. in size having increased 25 per cent.

ANALYSIS OF ELECTRIC STREET LIGHTING, MASSACHUSETTS, 1915

Classification of Population	Population per Town	Total Population	Total Towns	Total Miles	Miles per Town	Total Kilowatts	Kilowatts per Mile	Kilowatts per 1000 Population
0- 1,000	757	18,158	24	1,215	51	49.5	0.041	2.73
1,000- 2,000	1,485	89,085	60	3,054	51	277.2	0.091	3.11
2,000- 3,000	2,491	114,609	46	2,640	57	409.5	0.155	3.57
3,000- 4,000	3,602	53,030	15	1,065	71	167.9	0.157	3.17
4,000- 5,000	4,461	49,071	11	750	68	122.7	0.163	2.50
5,000- 6,000	5,487	1.5,237	21	1,671	80	371.3	0.222	3.22
6,000- 7,000	6,546	85,094	13	759	58	359.8	0.474	4.22
7,000- 8,000	7,562	52,936	7	354	51	225.6	0 637	4.26
8,000- 9,000	8,464	33,855	4	351	88	163.4	0.465	4.83
9,000- 10,000	9,452	75,818	8	584	73	229 0	0 392	3.02
10,000- 15,000	12,454	236,630	19	1,381	73	746.9	0.541	3.16
15,000- 20,000	16,888	185,764	11	857	78	638.0	0.744	3.43
20,000- 25,000	22,782	91,126	4	438	110	448.6	1.024	4.93
25,000- 50,000	37,712	565,681	15	1,536	102	1,837.1	1.196	3.25
50,000-100,000	79,204	396,020	5	581	116	1,213.8	2.090	3.06
100,000-500,000	119,470	716,821	6	920	157	2,958.1	3.215	4.12
Over 500,000	745,439	745,439	1	571	571	2,847.5	5.000	3.82

A. B. Lisle, Providence, R. I., urged central stations to encourage municipalities to install enough additional lamps to offset price reductions desired by the public authorities. The cost of service per lamp decreases rapidly as the spacing is reduced. There are nearly 15,000 street lights on the Providence system and low rates per lamp per year are in vogue, a 60-watt lamp being supplied for 4000 hours for $12. W. P. Schwabe, Windsor Locks, Conn., advocated the candle-power basis in making street lighting contracts.

Interesting Builders in the Electric Range

The Great Western Power Company devotes two stories of a building at 511 Sutter Street, San Francisco, Cal., to the exclusive sale of electric ranges and other heating devices. On the second floor, which is reached by a private elevator, the company has a complete and modern electric kitchen with accommodations

ANALYSIS OF 110 TYPICAL NEW ENGLAND CITIES SHOWING FORMER AND PRESENT PRACTICE IN ELECTRIC STREET LIGHTING

Classification of population	1,000-5,000				5,000-10,000				10,000-25,000				25,000-50,000				50,000-100,000				Over 100,000			
Population per municipality	2,995				7,549				15,179				34,048				70,949				181,493			
Municipalities	20				16				32				22				10				10			
Lamp	Former	Per Cent	Present	Per Cent	Former	Per Cent	Present	Per Cent	Former	Per Cent	Present	Per Cent	Former	Per Cent	Present	Per Cent	Former	Per Cent	Present	Per Cent	Former	Per Cent	Present	Per Cent
Carbon arcs	372	9	..	..	333	7	60	1	2,193	18	1,275	10	3,208	16	1,659	8	4,719	40	863	5	3,006	13	696	2
Magnetite and flame arcs	..	..	72	1	302	6	437	7	688	6	931	7	1,061	6	1,916	9	788	6	3,088	20	7,061	29	11,552	35
Mazda "C" lamps, 250 cp. and above	..	..	288	6	..	..	209	3	..	..	1,112	8	..	..	997	5	..	..	2,040	13	..	..	1,215	4
Total large lamps	372	9	360	7	635	13	706	11	2,881	24	3,318	25	4,269	22	4,572	22	5,507	46	5,991	38	10,067	42	13,463	41
Mazda lamps below 250 cp	3,742	91	4,519	93	4,400	87	5,653	89	9,082	76	9,747	75	15,374	78	16,031	78	6,387	54	9,851	62	14,000	58	19,828	59
Total arcs and incandescents	4,114	100	4,879	100	5,035	100	6,359	100	11,963	100	13,065	100	19,643	100	20,603	100	11,894	100	15,842	100	24,067	100	33,291	100
Magnetite arcs:																								
4 amp	..	..	57	100	..	..	374	86	..	..	634	68	..	..	414	24	..	..	957	31	..	..	3,664	32
5 amp	..	..	..	..	..	..	58	13	..	..	107	11	..	..	1,317	76	..	..	1,725	56	..	..	456	4
6.6 amp	..	..	..	..	..	..	5	1	..	..	190	21	..	..	..	..	..	..	406	13	..	..	7,432	64
Total	..	..	57	100	..	..	437	100	..	..	931	100	..	..	1,731	100	..	..	3,088	100	..	..	11,552	100
Mazda "C" lamps:																								
250-cp	..	..	162	56	..	..	16	8	..	..	605	54	..	..	215	22	..	..	75	4	..	..	594	49
400 cp	..	..	37	13	..	..	50	24	..	..	264	24	..	..	245	25	..	..	1,020	50	..	..	..	..
600 cp	..	..	79	27	..	..	143	68	..	..	231	21	..	..	448	45	..	..	945	46	..	..	571	47
1000 cp	..	..	10	4	..	..	..	..	..	..	12	1	..	..	89	8	..	..	..	..	..	..	50	4
Total	..	..	288	100	..	..	209	100	..	..	1,112	100	..	..	997	100	..	..	2,040	100	..	..	1,215	100

for serving electrically cooked meals to fifty or more people at a sitting. Henry F. Holland, who was recently appointed manager of the electric-range department of the company, is arranging to use these facilities for interesting architects, builders and electrical contractors in the use and installation of electric ranges and in securing closer co-operation between the power company and the men connected with building design and the building trade.

Getting Extra Christmas Sales Help from the Meter Department

"The regular appliance sales force can easily take proper care of a certain portion of the trade during the holiday rush," according to C. E. Yacoll of Youngstown, Ohio, "but the extra people that the holidays require, if picked up indiscriminately, are likely to know no more of the use of electrical articles than the person to whom they are trying to sell. This lack of knowledge creates a condition that may work injury to the total sales results.

"Why not, therefore, look to the meter department for a couple of clean and energetic young chaps who can give the afternoons to the retail store during the Christmas rush? They will have more than one reason for wanting to make a good sales record and the store manager should be mighty keen about giving them a chance to display their ability and to learn something of electrical appliances."

Waco's New "White Way" Erected by Popular Subscription

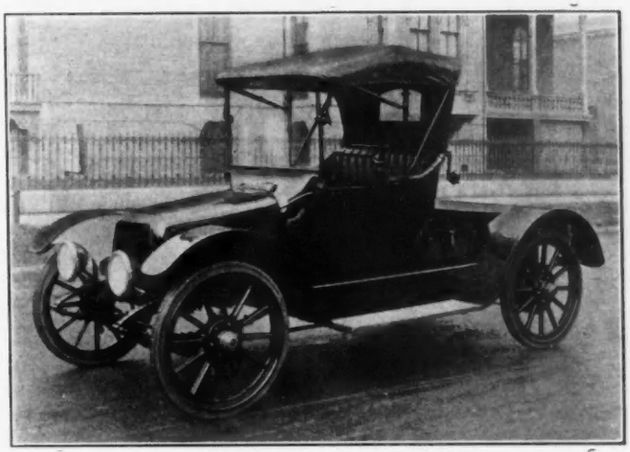
The movement to install a new white way at Waco, Tex., was originally started by the Waco Young Men's Business League, a local commercial organization that has been responsible for many local civic improvements. The funds for the installation of the white way were raised by popular subscription, with the understanding that the city would pay for the energy after the lamps had been installed.

"WHITE WAY" LIGHTING INSTALLATION AT WACO, TEX., PAID FOR BY POPULAR SUBSCRIPTION

The white way consists of forty-eight ornamental standards spaced 90 ft. apart, each carrying three 100-cp. units. Energy is furnished by the Texas Power & Light Company on a meter rate basis. The city takes care of the maintenance of the white way, including the renewal and replacement of lamps.

Electric Vehicle to Compete with Light Gasoline Cars

The first of a fleet of electric vehicles which is being built for the troublemen and outside-plant foremen of the Commonwealth Edison Company of Chicago has been delivered. This machine has a maximum speed of 22 miles per hour, the controller being arranged to give five speeds both ahead and reverse. The weight of the vehicle is 3300 lb. With its battery equipment of forty cells of 11 M. V. Hy-cap Exide, it has a radius of travel of 75 miles on a single charge. The cells of the battery are distributed equally fore and aft, so that the weight on the front wheels is equal to the weight on the back wheels. The wheelbase of the vehicle is 104 in., and although the first of the fleet shown herewith is equipped with solid tires, all of those which follow will be equipped with 34-in. by 4.5-in. pneumatic cord tires on demountable rims.



ELECTRIC RUNABOUT FOR TROUBLEMEN

The motor is of the type known as the Westinghouse-Chicago special motor, and is the same as those used in all Chicago Electric cars. This motor is connected to the axle through a Timken spiral bevel drive. Timken axles are also used both in front and behind.

Perhaps the body is the most interesting feature of the vehicle. It is the body from a Ford roadster, which was purchased at a cost of $35, the price which has now become standard with the light-truck companies that must buy them, but have no use for them. Through the use of this body and the specially designed hoods the company has been able to effect a considerable saving in total cost. In fact, it is said that these vehicles, with all costs and their longer life considered, will be able to compete favorably with the light gasoline cars the company has been using.

A Symbol for Electric Heat—the Red-Triangle "Fire Sign"

The electric industrial heating department of the Commonwealth Edison Company had devised a symbol which it will use on all of its literature advertising electricity for industrial heating purposes. The symbol is a red triangle, and in an explanatory booklet issued by the department is appropriately styled as "The fire sign, the symbol of mystic heat that mediæval alchemists vainly sought, the fire that was unquenchable and self-sustaining." The booklet goes on to explain that the "fire sign" approaches its true meaning when applied to electric industrial heat, and to point out the application of electricity to factory processes.

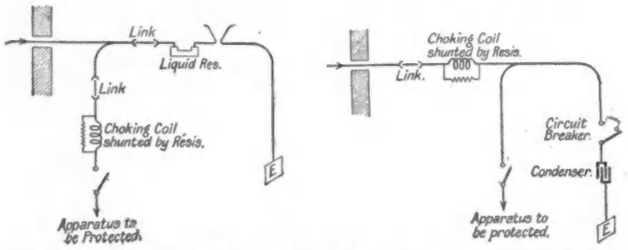
ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

ARRANGEMENT OF PROTECTIVE DEVICES

Practical Advice in Swiss Commission Report on Protection of Electric Installations

THE first portion of the report of the joint committee of the Swiss Electrical Society and the Association of Swiss Electricity Works on the fundamental principles of protection against surges was dealt with in our issue of Dec. 2, page 1109. We now take up the concluding portion, which gives practical



FIGS. 1 AND 2—USE OF HORN DISCHARGER WITH DAMPING RESISTANCE AND CHOKE COILS FOR VOLTAGES UP TO ABOUT 15,000; USE OF CONDENSERS WITH CHOKE COILS

advice. The complete original report may be found in Bulletin No. 6, 1916, of the *Schweizer Elektrotechnische Verein* and a long English translation in abstract in London *Electrician,* Oct. 27, 1916.

After some remarks on insulator design and the use of earthed guard wires it is pointed out that in all extensive systems of overhead lines it is advisable to install apparatus capable of insuring a continuous leakage of static charges to earth. Good results in this respect have been obtained with water-jet dischargers and iron-cored choke coils.

Water jets are not recommended for voltages above 40,000 to 50,000 volts unless they are of very perfect design, and provision is made for their careful supervision, and then only in cases where running water is obtainable cheaply and easily. They are cheaper than iron-cored choke coils, and their high resistance provides good damping.

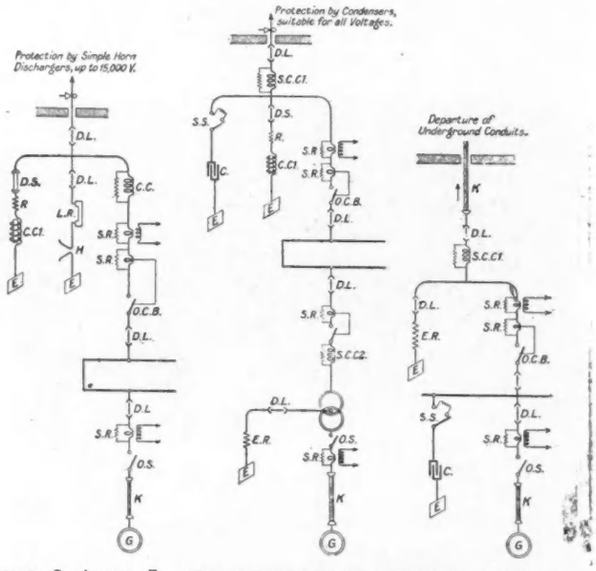
As the conductivity of water is very variable, the construction of the water jet must permit an easy regulation of the section of the liquid column and insure the stability of its form. The design in the form of a freely falling jet leads to a small water consumption, but has the disadvantage that under the influence of the strong electric fields associated with high-tension systems the jet has a tendency to break up and start arcs; for this reason this type is not suitable for circuits of more than 10,000 to 15,000 volts. For higher voltages it is preferable to use jets of water under pressure, either ascending freely or constrained in insulating tubes. The latter construction has the inconvenience of the liability of the formation of deposits in the tubes. In countries exposed to severe storms it is desirable to be able to decrease the resistance of the jets momentarily by increasing the flow of water.

Iron-cored choke coils may be employed on circuits of the highest voltages; they enable static charges to leak away rapidly, and do not require particular attention. These coils must be of the single-phase type, and must not be constructed as polyphase coils with common magnetic circuits. They should be connected to the line between the protective devices and the apparatus to be protected. The coils should be connected to high-tension lines through damping resistances to prevent the formation of oscillations.

No rules can be given for the determination of the number of static discharges required in any given case, but long lines should be earthed by this class of apparatus at least at both ends.

For the protection of machines and apparatus connected to aerial lines it is necessary to install devices to transform or break the line surges before they reach the apparatus. Among apparatus of this kind the report mentions choke coils, if necessary shunted by resistance, and instruments of the valve type, such as spark gaps with or without horn discharges, multiple gaps and condensers.

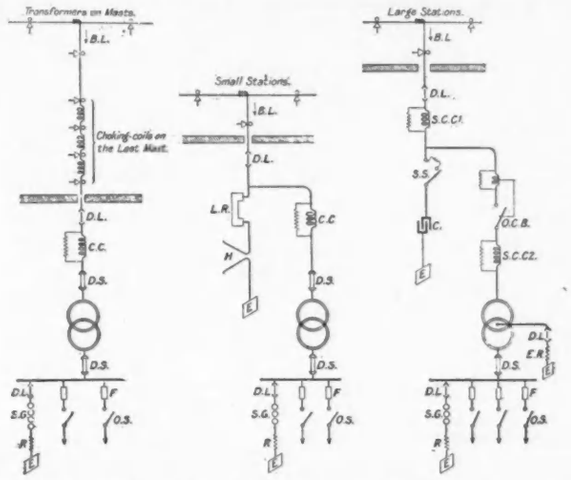
With multiple gaps between cylinders the damping resistance should not be greater than is required for the necessary limitation of the current through the apparatus when it acts. The damping resistances may be made of silite, carborundum, etc. At any rate resistance material should be used that does not vary and that is found after prolonged tests not to alter under the influence of heat. In aerial lines of small extent and low voltage (below 5000 volts), for which apparatus of this type is suitable, dangerous traveling waves are not generally to be feared, and on this account choke coils need not be used.



FIGS. 3, 4 AND 5—ARRANGEMENTS OF PROTECTIVE DEVICES IN STATIONS

Horn dischargers with damping resistances and choke coils can be used on direct-current and alternating-current systems for voltages up to 15,000 volts. For higher voltages they are not recommended, as the limitation of current through the apparatus would require such large damping resistances that insufficient protection would be given, particularly in very extensive aerial systems.

The length of the gap between the horns of the discharger should be set by experiment on the supply to which it is to be connected, as this length depends among other things on the wave shape of the voltage. The discharger should be mounted under cover and well protected, for if exposed to the open air, the greater length of gap required renders the action of the dis-



FIGS. 6, 7 AND 8—ARRANGEMENTS OF PROTECTIVE DEVICES IN TRANSFORMER STATION

charger uncertain. The energy of the surge is almost completely dissipated in damping resistances of a resistance equal to the surge resistance of the transmission lines, or of about 500 to 700 ohms for each aerial wire. This value should be approached as nearly as the limitation of the current permits. Greater values of the resistance may be taken if the aerial wires are protected at their entry to the stations by choke coils shunted by resistances (Fig. 1). Contrary to general practice, the damping resistances should be placed between the line and the horn discharger, so that the resistances may perform their function if the arc strikes neighboring metal parts.

This arrangement necessitates the use of well-designed damping resistances constructed of homogeneous material of good heat-resisting properties. Metal resistances are the best in this respect. Liquid resistances in troughs and in other constructions in which the current causes evaporation should be fitted with a mixture of water, glycerine and gravel, and the electrodes should have the greatest possible surface.

According to calculation the best protection is afforded for all voltages by combinations of condensers and choke coils. These should be installed, where their high price permits, on all extensive systems in which particularly dangerous surges are to be expected and for high voltages above about 10,000 volts. The arrangement recommended is shown in Fig. 2. Recommendations on the best dimensions are made in the report.

Figs. 3 to 5 show the arrangement of protection devices in stations, Figs. 6 to 8, the arrangement of protection devices in transformer stations. In these diagrams H represents horn-discharger to lead off surges of great amplitude; LR = liquid resistance, as damping resistance for horn-discharger; CC = choke coil shunted by resistance; $CC1$ = choke coil to lead off the static charges of the aerial lines, or piston jet discharger; R = solid resistance to damp oscillations in the discharge circuit; DS = disconnecting switch for the protective coil; SR = shunt resistance for the current transformers and high-tension switches to eliminate reflection of transmitted waves; E = earth plate; K = connecting cable for generators (their capacity protects the windings); DL = disconnecting link; OS = oil switch; OCB = automatic oil circuit-breaker with high-tension relay; G = generator; C = condenser to divert primary surges (traveling waves, surges with steep wave front); SS = switch with resistance step to protect the condenser; $SCC2$ = shunted choke coil to turn off abrupt waves from the transformer; ER = earthing resistance; $SCC1$ = shunted choke coil to divert surges due to switching or earthing; F = fuse; SG = spark gaps; BL = branch lines to station (which may be of iron wire).

Generators, Motors and Transformers

Single-Phase Motor.—W. C. K. ALTES.—An article illustrated by diagrams on the constant-speed single-phase motor which may be classified as the shunt compensated repulsion motor or as the repulsion induction motor. It is a combination of a repulsion and an induction motor, possessing the desirable characteristics of each of the two elements. The characteristics of the repulsion motor are high starting torque, high no-load speed and a large variation of the speed with the load. The characteristics of the single-phase induction motor are no-starting torque, a limited no-load speed equal to the synchronous speed, and a small variation of the speed with the load. The repulsion motor is unsuitable for general purposes on account of its high no-load speed and large variation of the speed with the load; the single-phase induction motor is equally unsuitable on account of its lack of starting torque. A combination of the two types of motors make it possible to take advantage of the desirable characteristics of both. It is merely necessary to sacrifice a part of the repulsion motor starting torque in order to secure the limited no-load speed and the flat torque-speed characteristics of the induction motor. After a general description of the principles of construction and operation, the author adds notes on commutation and the effect of resistance. A second article on this type of motor is to follow.—*Gen. Elec. Rev.*, December, 1916.

Lamps and Lighting

High Vacuum Pump.—IRVING LANGMUIR.—An illustrated article in which two new types of "condensation pump" are described, one built wholly of glass and the other wholly of metal. In these pumps a blast of mercury vapor carries the gas into a condenser. This action is similar to that in a steam ejector and in a Gaede diffusion pump. The method by which the gas is brought into the mercury vapor blast in the condensation pump is based on a new principle, which is essentially different from that employed in the steam ejector or Gaede diffusion pump. In the new pumps the gas to be exhausted is caught by the blast of vapor and is forced by gas friction to travel along a cooled surface. By maintaining this surface at such a low temperature that the condensed mercury does not re-evaporate at an appreciable rate, it is possible to keep the mercury vapor from escaping into the vessel being exhausted. The action of this pump therefore depends primarily upon the fact that all the atoms of mercury striking a mercury-covered surface are condensed (no matter what the temperature), instead of even a fraction of them being reflected from the surface. It is for this reason that the term "condensation pump" is proposed. The condensation pump is characterized by extreme speed (3000-4000 c.c. per second, or even more, if desired), by simplicity and reliability, and by the absence of lower limit (other than zero) to which the pressure may be reduced. By the aid of this pump pressures lower than 10^{-6} bars have been produced and measured. To obtain the full benefit of the high speed of these pumps, it is necessary to use connecting tubing of very large size.

Equations are given by which the effect on the speed of exhaustion produced by tubing of any given dimensions may be calculated.—*Gen. Elec. Rev.*, December, 1916.

Generation, Transmission and Distribution

Series Regulation.—A note on a recent British patent (13,801, 1915) of R. Thury for a method of regulating constant-current series machines, in which an exciter is provided, the field of which is differentially excited by the line current and a current derived from a constant-voltage source, and further by a compounding coil, the effect of which depends on the voltage across the terminals of the machine. The stability and sensitiveness of the regulation can be improved by the provision of a transformer, the primary of which carries a current proportional to the line current, while the secondary voltage impulses arising from variations in the line current are arranged to operate in series with that of the exciter.—London *Elec. Eng'ing*, Oct. 26, 1916.

Telegraphy, Telephony and Signals

Duplexing in the Squier System of Telegraphy.—Louis Cohen.—An illustrated article on the possibility of further developments in the Squier system of telegraphy in which an unbroken alternating current is used. In the present method of telegraphy, duplexing is accomplished by the use of a Wheatstone bridge arrangement, in which an artificial cable is used to balance the cable in regard to resistance and capacity. For the case of long-distance submarine signalling the artificial cable constitutes an important element; its design and construction must be executed with great care, and the cost is considerable. In the Squier system, however, methods can be developed by which duplexing is accomplished without requiring the use of an artificial cable, and thus it will be possible to eliminate at least one troublesome factor. Two new methods are discussed in the present paper. The first method proposed for duplexing, in which no artificial cable is required, is shown in Fig. 9. There are independent transmitting and receiving circuits, marked I and III respectively, both of which are linked electrically with the cable through transformers M_1 and M_4, and the transmitting and receiving circuits are linked together electrically through the intermediate circuit II and the two transformers M_2 and M_3. The operation is as follows: The current generated in transmitting circuit I is transmitted through transformer M_1 to cable, the current flowing in the cable induces an emf. in the receiving

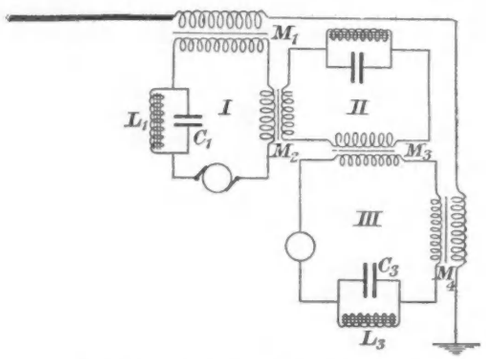


FIG. 9—METHOD I OF DUPLEXING

circuit III through the action of transformer M_4, but the transmitting circuit also induces another emf. in the receiving circuit through the intermediate circuit II, and the circuit constants can be arranged so that these two emf.'s neutralize each other completely—that is, they are of the same magnitude and exactly opposite in phase. To further insure, however, absolute freedom from electrical disturbances of the transmitter affecting the receiver, which may be due to lack of perfect balance, a loop circuit, L_3C_3, is introduced into the receiving circuit, which is tuned to be in resonance for the frequency of the current of the transmitter, and the loop circuit has the same effect as that of a very high resistance in the circuit in regard to the current

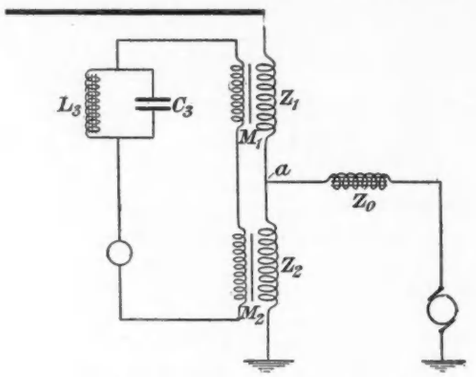


FIG. 10—METHOD II OF DUPLEXING

of the frequency to which it is tuned. For any other frequency the effective resistance of the loop circuit is practically only the ohmic resistance of the coil. It is obvious, therefore, that with such an arrangement of circuits the local transmitting current will have no effect whatever on the local receiver. For the signals to be received the conditions are different. Let the current generated at the distant station be of a different frequency from that of the local transmitter, and let the loop circuit L_1C_1 of the local transmitter be tuned to the frequency of the current of the incoming signal; hence the local transmitting circuit acts like a high-resistance secondary, the cable being the primary in this case, and therefore very little current from the incoming signal is induced in it, and none transmitted through intermediate circuit II to the receiving circuit. The current, therefore, of the incoming signal flows along the cable and acts only on the receiving circuit through transformer M_4. In this condition the transmitting current acts on the cable without affecting the local receiver, and the incoming signal acts on the receiving circuit without affecting the transmitting circuit. With a corresponding system of circuits at the other end of the cable the condition can be realized which makes it possible to have simultaneous sending and receiving. Another method for duplexing without the use of an artificial cable is shown schematically in Fig. 10. In this arrangement of circuits the current from transmitter divides at the branch point a, flowing in opposite directions through primaries of transformers M_1 and M_2, thus inducing emf.'s of opposite phase in the secondary which is the receiving circuit. As in the previous method, to guard against any disturbance in receiver due to possible lack of perfect balance, a loop circuit (L_3C_3) is introduced into the receiving circuit, which is tuned to the frequency of the current of the local transmitter. For the incoming signal, on the other hand, the current flows in the same direction through the primaries of both transformers M_1 and M_2, inducing emf.'s of the same phase in the receiving circuit. It is also assumed that the frequencies of the currents of the outgoing and incoming signals are different, so the loop circuit (L_3C_3) does not offer any great impedance to the current of the incoming signal. Having a corresponding system of circuits at the other end of the cable, simultaneous sending and receiving can be readily accomplished. The mathematical theory of both systems is given.—London *Electrician*, Nov. 10, 1916.

Readers' Views and Comments

What Should Be the Aim of Universities in Research?

To the Editor of ELECTRICAL WORLD:

SIR: For reasons which need not be discussed in detail, there has been a sudden awakening to the importance of research and to the fact that the majority of the universities and engineering colleges of the country have not been contributing their full share of investigation and leadership in knowledge. These at least seem to be the conclusions to which one is led by the perusal of papers and discussions of scientific societies or articles and news which are published in the technical press.

Referring to an item that appeared in a recent issue of the ELECTRICAL WORLD (Vol. 68, No. 19, page 892), one must be further impressed with the fact that there is an important question to be answered in this connection, namely, are there different kinds of research, and if so, which ones should a university foster and encourage and which ones should it give preference to?

As brought out very clearly by J. J. Carty in his presidential address before the American Institute of Electrical Engineers there are not different kinds and types of research—pure and applied or industrial—as the average man seems to think. The main distinction between pure and industrial research is one of motive. Faraday, Henry, Ampere and others were scientists rather than industrial research workers or inventors, because they did not care to keep their new knowledge a secret in order to turn it into dollars and cents, rather than because they employed methods of investigation peculiar to science and not common to invention.

Now, then, should it be the policy of educational institutions to support and encourage investigations which are fundamental and so called, theoretical in their nature and of apparently remote practical application first, and investigations which promise an immediate useful application, second, or vice-versa? It must be clearly understoood that all research is utilitarian in that it will have its direct or indirect application some day. It must also be clearly understood that the inventor who uses and applies the principles of the scientist is just as necessary and useful as the latter. Society needs them both and, as emphasized by Carty (*loco. cit.*), students of schools even with the most practical aims would be benefited to a very great extent by the influence of "a discoverer in science."

It seems to the writer that it is important and necessary for universities and technical schools to have an honest and clear understanding as to what shall be their policy in regard to this question. Evidently there can be no objection to developing both kinds of research; indeed, past experience shows that a Remsen may accidentally invent saccharin, and that commercial industrial research laboratories may produce and publish some very high grade pure scientific knowledge. Industrial corporations have an honest clear cut policy in regard to this question, and it is necessary that educational institutions have theirs for the very important reason that such a policy will have a paramount influence on the quantity and quality of both the technically trained men which these institutions will produce, and on the quantity and quality of their research and of their influence on society at large. Furthermore, a definite policy will indicate and suggest solutions to different problems such as "the disposition of the results of research work when conducted with the assistance of outside parties commercially interested in the results."

This is an important and difficult question and thus we find that of the engineering graduates of the University of Michigan, 12 per cent favor exclusive use of the results of the research work by the donor, 40 per cent favor limited use—whatever that may be, 19 per cent favor full publicity and 29 per cent are uncertain or non-committal.

N. S. DIAMANT.

The Rice Institute, Houston, Tex.

The Sperry Searchlamp

To the Editor of ELECTRICAL WORLD:

SIR: My attention has been called to the issue of the ELECTRICAL WORLD for Sept. 23, 1916, specifically to an article descriptive of a searchlight credited to Elmer A. Sperry. I have seen such and similar articles not only in technical journals, but also in the daily press. I read these articles with considerable astonishment, since I found myself on very familiar ground, having seen every essential element of the reputed Sperry searchlight several years ago in the searchlight of Heinrich Beck, of which I furnished you data, and which you embodied in an article in the issue of the ELECTRICAL WORLD for July 25, 1914.

From whatever point of view I look at the so-called Sperry lamp, I am at every turn reminded of the Beck structure, and the Sperry creation appears to me a free and loose aggregation of the elements used in the Beck system. There are features in the Sperry construction which differ from the Beck lamp, but these do not mark a departure from the Beck system or from the Beck idea; in other words, the so-called Sperry searchlight is still a Beck searchlight.

It is only fair to Mr. Beck, for whose advent in the United States I am largely responsible, to indicate to the readers of your valuable paper the impression which the Sperry publications produce upon one who is familiar with the subject.

LOUIS J. AUERBACHER.

New York City.

Pipe Coating to Prevent Electrolysis

To the Editor of ELECTRICAL WORLD:

SIR: Electrolytic and chemical corrosion of underground pipes has long been a matter with which gas and water interests have been seriously concerned. Of the various methods adopted to prevent this action perhaps the one best known, oldest and most generally used is that of covering the pipes with some form of coating, notably paint. There are many different brands of such coatings upon the market, from low to high prices, and rendering fair, poor, bad and indifferent service. Whatever the price of the paint used, however, the service is usually erratic. In one place the coating may give fairly pleasing results as regards protection and life, whereas the same grade of paint put on the same make of pipes at the same time by the same men with equal care but with the pipes installed in another location fails rapidly or gives no protection whatsoever, or possibly appears to hasten deterioration.

A large gas company which has experimented with nearly fifty different paints at widely different prices and applied in many different ways has found that the cost appears to be no criterion of results, which were unsatisfactory in every case. Finally a coating was developed which costs considerably less than the majority of patented ones experimented with, and also gives far more uniform results. This company has been using this coating for about six years and has obtained a satisactory protection at a low cost although its pipes traverse a city containing almost every conceivable sort of soil, a network of car tracks and a direct-current distributing system underground.

The coating used consists of a clean tar pitch free of water, soluble matter and acids. This pitch has a specific gravity of about 1.28 at 60 deg. Fahr. when shipped to the various dipping stations distributed throughout the city. Before treatment all pipes are thoroughly cleaned of all grease, rust, scale, moisture, etc. The clean pipes are then placed in a long wooden trough about 1 ft. wide and 0.75 ft. in depth in such a way that steam can blow through them, thus heating them. The pipe is then let down into the hot pitch and slowly revolved by means of a crank, and in revolving wraps upon itself a piece of muslin. This muslin is about 6 in. in width and is wound to have an overlap of about 1 in. In winding, the muslin becomes impregnated with the hot coal tar and a coating is formed free from air pockets and is homogeneous throughout.

This method of coating pipes is simple and tends to produce uniform results when carried out by unskilled labor, and is low in cost. No coating has yet been found which protects under all conditions of soil and electrolytic action, but for the conditions existing in the city soils and for electric currents which are not extreme this method of coating more than justifies the cost.

GILBERT RUTHERFORD.

Evanston, Ill.

H. G. STOTT

H. G. Stott, chief engineer for the Interborough Rapid Transit Company, New York City, and consulting engineer for the new steam generating plant of the Buffalo (N. Y.) General Electric Company, has sufficiently recovered from his recent severe illness to go on a month's trip to Cuba.

John Hunter, chief engineer of steam plants for the Union Electric Light & Power Company, St. Louis, Mo., has been chosen to succeed the late A. C. Einstein as a member of the company's board of directors.

John W. Hooley has opened an office as contracting electrical engineer at 95 Liberty Street, New York City. Mr. Hooley was formerly chief estimating engineer for the Watson-Flagg Engineering Company, New York City.

Trevor C. Neilson, who has been appointed claim agent of the East St. Louis & Suburban Railway Company and related properties, with headquarters at East St. Louis, Ill., was formerly assistant claim adjuster of the Columbus (Ohio) Railway, Power & Light Company. Prior to his connection with the Columbus Railway, Power & Light Company in 1914, Mr. Neilson was in the service of the United Railroads of San Francisco. Mr. Neilson was born abroad and is an attorney by profession.

Charles S. Ruffner has been elected vice-president of the Union Electric Light & Power Company of St. Louis, Mo., succeeding A. C. Einstein, whose death was reported in the ELECTRICAL WORLD of Nov. 25. Mr. Ruffner, who is to represent President Mortimer in the management of the Union Electric Company, has been acting as general manager of the Electric Company of Missouri, since the completion of the 100,000-volt transmission system from Keokuk to St. Louis. Prior thereto Mr. Ruffner was connected with the Central Colorado Power Company in the construction of its high-tension lines from Shoshone and Boulder to Denver. Mr. Ruffner is a fellow of the American Institute of Electrical Engineers. He was graduated from the University of Missouri in 1900.

Men of the Industry

Changes in Personnel and Position— Biographical Notes

W. C. Stevens, who has just been appointed sales manager of the Cutler-Hammer Manufacturing Company, of Milwaukee, has been manager of the company's New York office during the last three years. Mr. Stevens graduated from Cornell in 1906 with the degree of mechanical engineer, and at once took up the shop, testing room and engineering course at the Milwaukee factory, later going to the Pittsburgh field, where he devoted his time to sales, engineering and installation work. On returning to Milwaukee Mr. Stevens did considerable design work, many features patented by him being incorporated in the Cutler-Hammer furnace skip-hoist controllers. In 1911 he took temporary charge of the Chicago office, and in October, 1913, he was sent to New York to assume managership of that district.

George F. Morrison, general manager of the Edison Lamp Works of the General Electric Company, has been elected vice-president of the General Electric Company. He was born in Allegheny County, Pa., on Feb. 22, 1867. Ten years later he came to Harrison, N. J., where he attended the public schools until 1882, when he entered the employ of Thomas A. Edison, unwrapping lamp bulbs. From that time on, with the exception of the two years 1883 and 1884, when he had to give up his work on account of ill health and live out of doors, Mr. Morrison has been continually engaged in the lamp business at the Edison works. He has filled practically every position from office boy to general manager. Mr. Morrison is a member of the manufacturing committee and of the sales committee of the General Electric Company.

G. F. MORRISON

C. E. SCRIBNER

Charles E. Scribner, who has just completed forty years of service with the Western Electric Company, has, at his request, been relieved of executive duties as chief engineer to become consulting engineer for the company. During his long connection with the telephone industry Mr. Scribner has been one of America's most prolific inventors, having filed applications for more than 700 patents, of which nearly 500 have been granted. Although Mr. Scribner's principal inventions have related to telephone apparatus, at one time earlier in his career he gave attention to other electrical devices, including generators and arc lamps. In recent years, many of his contributions have been to the development of the telephone switchboard. Mr. Scribner is a fellow of the American Institute of Electrical Engineers and in 1913 served as a director and vice-president of the organization. Frank B. Jewett, who succeeds Mr. Scribner as chief engineer, has held the position of assistant chief engineer of the Western Electric Company since 1912.

Obituary

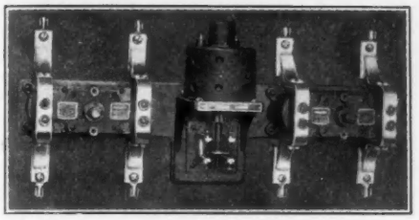
Josiah Quincy Bennett, president of the Cambridge (Mass.) Electric Light Company, died at his home in Cambridge on Nov. 29. Mr. Bennett was born in Somerville, Mass., sixty-two years ago. His business experience included association with various banking institutions and industrial concerns, and at the time of his death he was also president of the Weymouth (Mass.) Light & Power Company, the Weymouth Water Power Company, Commonwealth Gas & Electric Company, Athol Gas & Electric Company, Marlboro Electric Company, and was a director of the Amesbury (Mass.) Electric Light Company and the Dedham (Mass.) & Hyde Park Electric Light Company. Mr. Bennett supplied the power for the first electric car service operated in Massachusetts, between Harvard Square and North Cambridge, under the auspices of the Whitney interests, which controlled the West End Street Railway.

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Remote Control Switches

In the accompanying illustration is shown a combination of two "Diamond H" remote control switches and a controlling relay, which operates as an automatic double-throw switch. The



SWITCH THAT CONTROLS SAME LOAD FROM TWO SOURCES

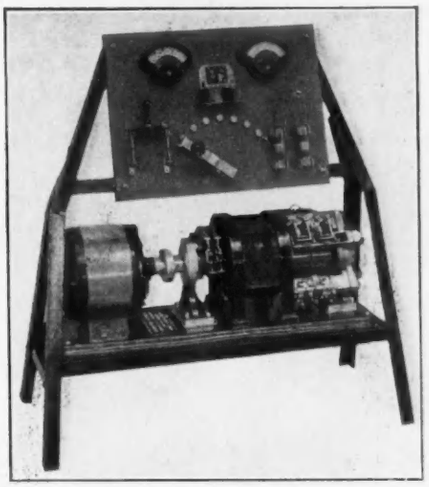
switches control the same load but from two sources of supply. In the normal position of the arrangement one switch is closed on the regular source of supply and the other is open, the relay being held "up" by current from the regular source. Upon failure of energy from regular source, the relay drops, opening the closed switch and closing the open switch, thus automatically transferring the load from the regular source of supply to an emergency source, without appreciable interruption of service, although one switch cannot close until the other opens. Upon resumption of current from the regular source the load is automatically transferred back to that source.

These switches are built in sizes from 25 amp. to 400 amp. rating, alternate current or direct current, or one alternate current and the other direct current, and single, double or triple pole. The use of this combination is paticularly desirable in buildings furnishing their own light during certain hours of the twenty-four, and more especially in public buildings for emergency service. This device is made by the Hart Manufacturing Company of Hartford, Conn.

Battery Charging Outfit

True dynamic commutation, with no breaks or open circuits, is claimed for the small rectifier developed by the Electric Converter Company, 840-846 Dorr Street, Toledo, Ohio. The rectification takes place in the transformer, an original direct-current commutator being used in connection with it, and direct current taken from the transformer. The transformer, as will be noted from the illustration, is mounted directly on the main shaft, in front of the commutator. In action, the current passes through one portion of the transformer, through the commutator and back into the transformer. The wave is caught and followed on the crest.

These machines, which are made for any voltage, phase, cycle or capacity, have shown under test an efficiency of 95 per cent, it is claimed. The machine has been used to operate a moving picture arc at 45 amp., charge a twenty-eight-cell electric car at an average of 35 amp. and operate a 2-hp. motor all at the same time. Attention is also called to a test to further demonstrate the durability of the device, in which a direct short-circuit was caused made by placing the two ends of the wire together when the machine ran for fifteen minutes without in any way affecting it. At the present time



RECTIFIER WITH TRANSFORMER MOUNTED ON MAIN SHAFT

the device is made in four sizes, one for charging one to eighteen cells, or any combination up to eighteen, one for charging electric cars up to twenty-eight cells, one for charging electric cars and trucks up to sixty cells, and one for operating moving picture arcs.

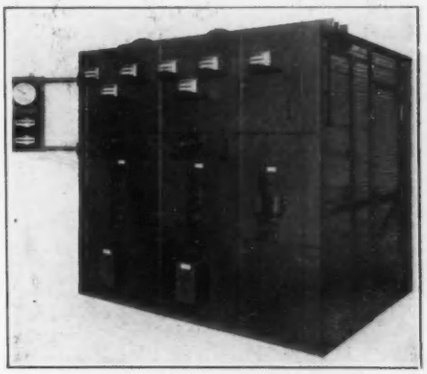
Non-Corrosive Soldering Paste

A soldering paste which contains no acid and is non-corrosive is being offered to the trade by the Sieffert Electric Company of Evansville, Ind. This paste is said to be especially effective in armature building and repair work since it contains no ingredient which may become an electrical conductor and lead to flash-overs and short-circuits on repaired machines. It can also be safely applied with the fingers. The paste is put up in 2, 4, 8 and 16 oz. cans.

Improved Switchboard Construction

A recent development in switchboards which embodies several desirable features of safety and convenience is shown in the accompanying illustration. All live parts, except current and potential receptacles, are inaccessible from the front of the board and the live parts of these receptacles are recessed so that accidental contact with them is difficult. Grille work screens afford protection against accidental contact with live parts in the rear of the board. Hinged doors provided with spring locks are placed one on each side of the grille work, making it impossible for any one other than an authorized person holding the key to enter the space at the rear of the switchboard.

Disconnecting switches are used between all oil circuit breakers and busbars and provide convenient and rapid isolation of the breakers from the bus for inspection, changing oil, or repairs, without hazard. Instead of the usual calibrating switches back of the panel, this board is equipped with front of board calibrating receptacles which permit safe and convenient calibration of instruments and meters from the front. Insertion of plugs in the calibrating receptacle connects the testing instrument in series with the instrument under test. The board is also equipped with removable fuse receptacles of the screw plug type which pro-



SWITCHBOARD WHICH EMBODIES SAFETY AND CONVENIENCE FEATURES

vide for a replacement of secondary potential transformer fuses from the front of the switchboard without the danger of contact with live parts.

The live parts of the field switches are mounted on slate bases back of the panel and are connected to operating handles on the front of the board by rods and bell cranks. This method of mounting field switches is a develop-

ment of importance, it is pointed out, since it is impossible for the switchboard attendant to be injured by the arc or to come in contact with live parts of the switch when operating. Instruments and other adjacent equipment are likewise protected from burning which sometimes happens with the front of board type of field switch.

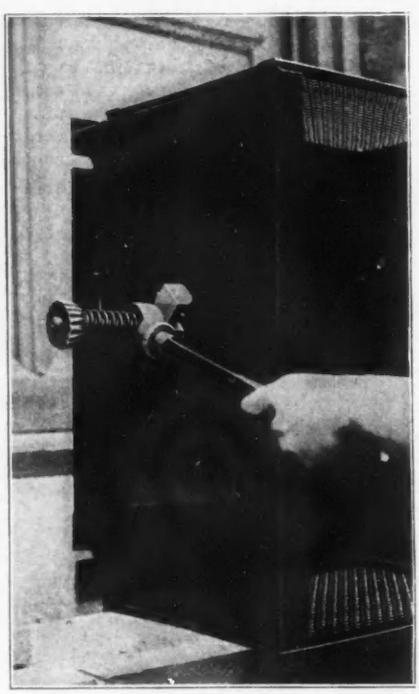
When switches are required for arc or incandescent circuits, the switches are of the dead front plug type. All live parts are back of the panels and cannot be touched from the front. This result is obtained by using two tubular receptacles and a two-point double-break switch plug per pole. The entrance bushings for receptacles are of molded material and extra large in size.

The panels described are for general power and lighting service up to 3500 volts, 25 to 60 cycles, and are manufactured by the General Electric Company, at Schenectady, N. Y.

A Handy Operating Cutter

An easily operated tool for making an additional hole in a metal cabinet, metal lockers or inclosing cases is now being manufactured and marketed by the Universal Tool & Appliance Company, Stroh Industrial Building, Milwaukee, Wis.

This device can be used for cutting all sorts of metal, fiber and slate, and can be adjusted so as to cut holes of various sizes with little effort and in but a few moments. To use the tool, all



CUTTER FOR MAKING HOLE IN METAL

that is necessary is to drill a pilot hole through the material and through this the stud is passed. A flange-nut is then secured on the opposite side of this stud and a few operations of a ratchet-wrench cut out a neat hole. This device, it is claimed, will do the work of a 6-in. drill-press and it is particularly convenient since it can be taken to the job. In case work is to be done on a tank where the flange-nut cannot be secured to the stud on the inside, it is only necessary to tap the pilot hole and insert the stud into this hole. The maker claims that this tool is especially adapted for work in automobile garages, boat-building plants and in all industrial works.

Magnetic Lock-Out Switch

The Igranic Electric Company, Ltd., 147 Queen Victoria Street, London, has produced a switch of the series lock-out type, which, by reason of its construction, is said to be more definite and positive in its operation than the single coil types now available. It is provided with two entirely independent magnets or magnetic systems adapted separately to influence a movable switch member, but energized by a common current. That is to say, the essential feature of the "Igranic" series lock-out switch consists in the provision of two magnets instead of one, namely an operating (or

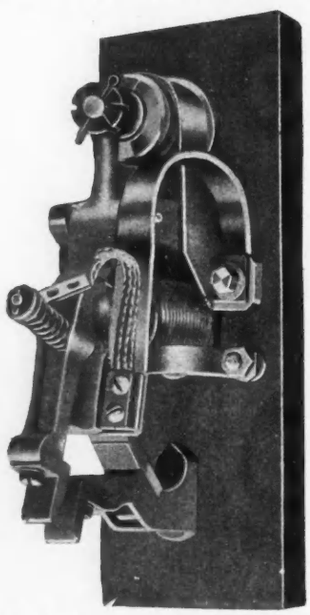


FIG. 1—SERIES WOUND TWO-COIL MAGNETIC LOCK-OUT SWITCH

closing) magnet and a lock-out magnet, whose windings are connected in series, the arrangement being essentially such that the two magnetic circuits or systems are entirely separate and independent, so that each magnet is free to operate in accordance with its own magnetic characteristics, unaffected by the characteristics of the other.

In this series lockout switch which does not depend for its action on a restricted section in the magnetic circuit, the closing and sealing power is not limited and the pressure and sealing distance of the contacts is run up to the maximum with a given size of winding. Both the locking-out and the closing functions are rendered more positive by the fact that the magnetic circuit around the closing coil is arranged to shunt a portion of the flux away from the switch arm while the switch is open. This shunted flux is passed through the switch arm as the latter approaches the closed position. When the arcing tips touch, the winding of the lock-out magnet and a section of the starting resistance are short-circuited. At this point a further additional im-

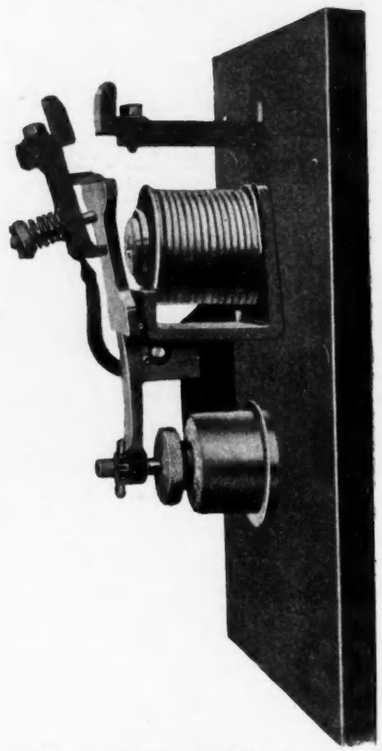


FIG. 2—SIDE VIEW OF TWO-COIL MAGNETIC LOCK-OUT SWITCH

pulse is given toward the sealing position; first, by the entire removal of any restraining effect of the lock-out magnet on the arm, and secondly, by the momentary increase of the current in the coil of the closing magnet by reason of the peak which results from the removal of the starting resistance from the circuit. There being, as stated above, no restriction in any part of the magnetic circuit of the closing coil, all the additional flux produced by increasing the current in that coil has a free path, and is used to good advantage for getting a high pressure on the contacts and long sealing distance.

Except in the smallest size, the "Igranic" switch has two sets of contacts, namely, a copper leaf brush pressing against a copper plate for the main contacts and solid copper renewable arcing tips to protect the main contacts when closing and opening the circuit, and as both contacts are vertical, dust cannot settle upon them. Another unique feature of this series lock-out switch to which attention is called is the convenient means provided for adjusting the current limit at which the switch will close. This consists of an adjustable plug mounted on the lower end of the switch arm, by which the air-gap between the lock-out magnet and the lower end of the arm can be varied. This adjustable plug has a number of positions. Each position represents 2.5 per cent of the switch rating, thus providing means of adjusting the switch without using an ammeter.

Electric Furnace Equipment

The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., through its close association with the development of the electric furnace, has developed complete electrical equipments for all classes of furnaces. These include, for the arc type of furnaces, assuming high-tension alternating current is available, the following apparatus: Line protective equipment,

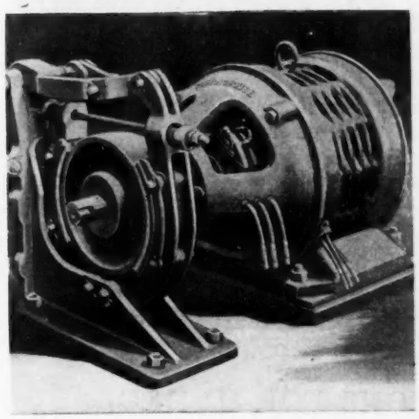


FIG. 1—TILTING MOTOR FOR ELECTRIC FURNACE

switchboard, step-down transformers, furnace tilting motors, motors for adjusting position of electrodes, and a regulating system for the control of the electrode motors.

On all large electric furnaces of the tilting type the tilting mechanism is operated by a motor. Either alternating or direct-current motors with characteristics similar to those used for hoisting work are suitable for this service. The controller is of the reversing type and a motor brake is used to prevent over-travel of the furnace and hold it in any desired position. For this service the company has a complete line of both alternating and direct-current tilting motors, ranging from 15 hp. to 150 hp., together with suitable controllers and brakes.

One of the greatest improvements made in the modern furnace is the feature of automatic regulation of the current. The object of the regulating system is automatically to maintain a constant current at the furnace. The Thury system is used on a large percentage of the electric furnaces now installed. It can be used with any arc furnace to maintain a constant current which can be adjusted through a wide range. It can also be adapted for maintaining a constant potential when desired. The equipment for the automatic control of a three-phase furnace consists of: Three regulating equipments, including wall brackets, one countershaft complete with pulleys and bearings, one motor to drive countershaft, three regulating drum controllers, three field regulators, three resistances, and two series transformers.

Damping devices permit the regulator to act only when necessary. Sudden changes and peaks of short duration will not put the regulator in action. This in itself is very important, as there is not only a great saving in the wear and tear of the electrode hoisting mechanism, motors for driving same, etc., but the current is kept more uniform by avoiding unnecessary regulation.

Each regulator controls one electrode. The regulator is controlled by a solenoid energized by means of current from series transformers in the main high-tension circuit. The regulator in turn controls the armature circuit of the electrode motor to give it motion in either direction, or stop it, as required. This electrode motor operates a hoisting mechanism, which in turn raises or lowers the electrodes. The regulator can handle any amount of power for regulating purposes without impeding the free play of the controlling mechanism, which is only in contact with the power mechanism for exceedingly short periods of time and is otherwise perfectly free. Intermittent action of a contact-making arm prevents the regulation from being carried

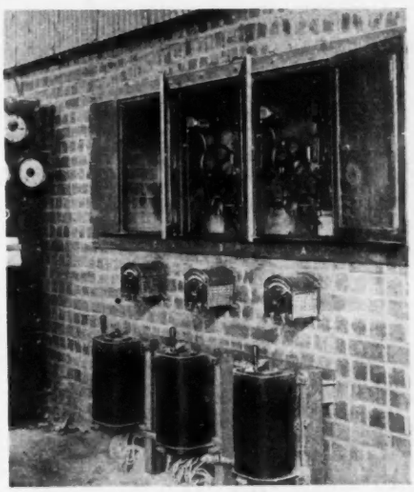
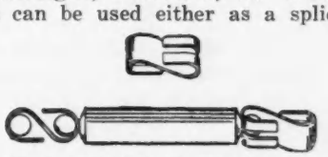


FIG. 2—THURY REGULATOR FOR ELECTRIC FURNACE

too far in one direction. Thus a high-load power factor and a uniform current on the furnace is assured at all times.

Insulators for Pull Socket Chains

Splicing links and insulators, such as shown herewith, have been designed for use on pull socket chains by Thomas M. Harrigan, Woodstock, Vt. This device can be used either as a splicing



SPLICING LINK AND INSULATOR FOR PULL SOCKET CHAIN

link or an insulator or for both. The insulators are for use mostly in baths, kitchens and basements, where there is a possibility of the consumer's circuit becoming grounded or a transformer breaking down and causing a high voltage on the house circuit.

Fixture for Nitrogen Lamps

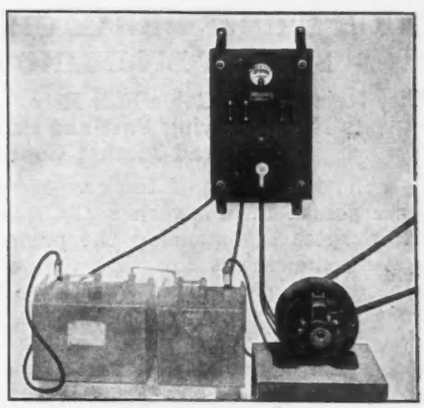
Fixtures, such as shown in the accompanying illustration, designed especially to meet the demand created by the nitrogen lamp are being made by Samuel Frost, 304 Bowery, New York City. The lighting unit illustrated is adapted for 100 to 300 watt lamps and has a 16-in. reflector and an 11 in. by

FIXTURE FOR 100 TO 300 WATT NITROGEN LAMPS

6 in. bowl. For lamps of 300 to 500 watt rating, the reflector is 20 in. and the bowl 11 in. by 6 in. These units are furnished either wired or without wiring according to the local requirements of the user.

Improved Battery Charging Set

Several improvements have recently been made by the Main Electric Manufacturing Company of Pittsburgh, Pa., on its battery charging set. A high-grade D'Arsonval type ammeter, of the zero-center, double reading type, has been added to the equipment of the outfit. The leads running from the switchboard to the batteries are 8 ft. in length



BATTERY CHARGING SET WITH SEVERAL IMPROVEMENTS

and contain an improved type of clip of acid-resisting construction. The positive clip is red to aid a workman in distinguishing the polarity of the leads. Further details of this set were given in the July 1, 1916, issue of the ELECTRICAL WORLD on page 38.

NEWS OF THE INDUSTRY

A Review of Activities in the Electrical Manufacturing, Selling and Central-Station Fields

FIRST STEP FOR LARGER SEATTLE MUNICIPAL SYSTEM

City Council Authorizes Bond Issue to Provide for New Steam Generating Plant, Doubling Present Steam Reserve

The Seattle City Council, at a meeting on Nov. 27, passed an ordinance providing for the construction of a steam electric power plant adjoining the site of the existing Lake Union steam auxiliary plant of the municipal system, to cost approximately $390,000. This, it is felt, practically assures the big steps in the development of the city's light and power system, which has been declared inadequate by Superintendent Ross to supply the increasing needs. The ordinance authorizes a utility bond issue, not to exceed $390,000; the bonds can be issued either in denominations of $100 or $1,000. The bonds are to bear interest at not to exceed 5 per cent, both interest and principal payable from the revenues of the light and power system, and to be retired in equal annual payments—the first six years from date of issuance and the last twenty years from that date. The King County Superior Court has held that the City Council has the right to authorize the issuance of such bonds, but the Supreme Court has never passed on the question. According to city officials, a friendly suit undoubtedly will be instituted before the bonds are issued in order that the highest court in the State may validate or invalidate the issuance of the bonds.

By the passage of the ordinance for the construction of the plant the Board of Public Works is authorized to prepare plans and specifications and to invite bids for construction. The proposed plant will double the capacity of the present steam auxiliary, increasing it from 7500 kw. to 15,000 kw.

HIGH PRICES DELAY CHICAGO STREET LIGHTING EXTENSION

City Rejected All Cable Bids Recently Submitted and Is Now Studying Past and Present Copper and Lead Market Conditions

While the voters of the city of Chicago have long since passed favorably on a $3,750,000 bond issue for the purpose of extending the present street lighting system, indications are that the money may not be expended as promptly as was expected. The finance committee of the City Council must appropriate the money derived from the sale of the bonds before purchases can be made. The funds have not yet been appropriated for this work, and it is rumored that they will not be appropriated as long as the prices of cable and other material remain at their present level. The finance committee has part of its staff at work studying the past and present market conditions in copper and lead, and it is expected that the committee's action will depend upon what this investigation brings forth.

It will be remembered that under the date of Aug. 19, 1916, the city advertised for bids on cable for a part of its lighting system, comprising 6000 100-cp. lamps. The advertisement called for bids on all or any part of 2,000,000 ft. of No. 8 600-volt, varnished-cloth, lead-covered, steel-taped cable, and on all or any part of 250,000 ft. of No. 8 5000-volt varnished-cloth, lead-covered, steel-taped cable. Delivery was asked on or before Nov. 15, 1916, at any rate it could be made. Among the bids received only one offered any cable that met the specifications as to delivery. This one manufacturer offered a total of 145,000 ft. of the 600-volt cable at a price of $16.10 per 100 ft. The city rejected all of the bids, and expected to readvertise for the cable. This has not been done, however, and there is a question in the minds of some of the city authorities as to whether it will be done under present conditions.

INVESTIGATIONS FOR HYDRO-ELECTRIC DEVELOPMENTS

Studies Made to Determine Storage Capacity of New England Streams—Private Interests Defray Costs of Public Improvements

At a hearing before the Massachusetts Gas and Electric Light Commission not long since President Philip Cabot of the Turner Falls Power & Electric Company discussed the value of ample engineering investigation in connection with hydroelectric projects.

The company recently expended two years in making detailed surveys of the banks of the Connecticut River for a distance of 20 miles above the dam at Turners Falls to determine the storage capacity of the stream with flashboards of varying height. Four men constituted the party and the work was practically continuous, costing about $10,000. Mr. Cabot said that the information secured is worth $10,000 a year to the company in reduced operating expenses, and that the effect of freshets was studied as well as the volume of water which will be stored above the dam at times of high water.

Considering possible future developments on the Millers River, Mr. Cabot pointed out that important savings have been anticipated by the company through the purchase of certain lands prior to development. As for capitalizing such preliminary work, Mr. Cabot said that if the consumer is not burdened with it now he will have to pay three or four times as much later when the development is carried through in conjunction with a possible storage scheme provided through state action. In the meantime the public gets the benefit of the taxes.

Mr. Cabot said that the summer flow of the river is very low, sometimes reaching 1 per cent of the spring flow, the actual range being from 1500 to 100,000 cu. ft. per second in a single year. Anything which can be done to build up the low-water flow will be a great advantage to all users of power on the stream, and possibly to navigation below Hartford and between Springfield and Hartford. It has been found exceedingly difficult to secure co-operation in developing storage facilities among different water users. Most of the users on the Connecticut will refuse to pay for the benefits of others' work in this field, there being no legal obligation involved. There are eight dams on the Connecticut River

between Windsor Locks, Conn., and McIndoes, Vt., near the head waters of the main stream, and there are considerable heads still undeveloped, notably in the so-called 15-mile fall, where there is a drop of 250 ft., above Wells River, Vt.

Mr. Cabot said that he considered the present situation in regard to storage development very unsatisfactory, but that some hope exists for future betterment. There are marked tendencies in other states outside of New England to legislate in such a way that the development of these storages is made possible, if people who get an actual cash benefit have to pay for it. The cost of developing one reservoir on the Moose River is so low that if anyone else would co-operate the power which can be developed from that water in summer at from 3 to 4 mills per kilowatt-hour would not now have to be generated by steam at a cost of about 1 cent. Such a reservoir would be filled and the water let out during, say, 100 consecutive days in the low-water months of the summer. The company has entered into agreements with some of the water users on the river for improved development and use through the building of higher dams and enhanced storage. Four of the developed powers on the river have contributed to this work, and some progress has been made in building up the low-water flow of the stream. Mr. Cabot stated that while this work is in its infancy and depends much upon legislative authorization, its cost is in his opinion a proper capital charge which may grow to be large.

Speaking of the recent hydroelectric developments at Montague City, near Turners Falls, Mr. Cabot said that the installation of 63,000 hp. in waterwheels represents an outlay of about $4,000,000, or about $65 per horsepower for the development, and that the money invested by the company in the town of Montague in the past three years (about $3,000,000) is about a third of the entire assessed valuation of the town. This investment has reduced the town tax rate several dollars, and the speaker felt that a public utility accomplishing such work ought to receive credit for thus contributing to the prosperity of the local communities. The power which the company can generate at Turners Falls means a saving to someone of more than 100,000 tons of coal a year. The company now pays taxes of about $75,000 a year in the Connecticut Valley, and this money, $60,000 of it new, will go to the towns whether the hydroelectric company's stockholders get any dividends or not.

GOVERNING PRINCIPLES OF HEAT DISTRIBUTION

B. G. Lamme and F. D. Newbury Present Papers on Temperature Rise at the Meeting of the Chicago Section, A.I.E.E.

At a joint meeting of the electrical section of the Western Society of Engineers and the Chicago section of the American Institute of Electrical Engineers at Chicago on Nov. 27, papers were presented by B. G. Lamme and by F. D. Newbury of Pittsburgh on "Temperature Distributions in Electrical Machinery" and "Rational Temperature Guarantees for Large Alternating-Current Generators" respectively. In his paper Mr. Lamme explained the fundamental principles which govern heat distribution. Mr. Newbury's paper elaborated on a special application of principles expounded in Mr. Lamme's paper. The authors also urged standardization of temperature guarantees when the guarantee is based on internal temperatures.

The trend of the discussion indicated that while designing engineers are ready to accept 150 deg. C. as a safe temperature, some operating engineers are still in doubt as to the advisability of going to such temperatures. The futility of operating companies placing reliance in temperatures measured externally was also brought out. A. M. Lincoln said he was interested not so much in the present limit of temperature as in the ultimate limit to which machines in the future might be expected to operate. He presented equations to show that 250 deg. C. will be the limit if the temperature coefficient for thermal conductivity is the same as for electrical conductivity. He urged that data be collected to determine whether or not these coefficients are identical. A representative of the Commonwealth Edison Company recalled troubles with early machines not equipped with exploring coils and stated that all of the company's large generators are now equipped so that internal temperatures may be taken. The wisdom of using exploring coils in Chicago has been demonstrated by incidents wherein machines that began to run hot have been taken down and found to be chocked with dirt.

In closing the discussion Mr. Lamme said that the weight of cooling air passing through a large generator in forty minutes will equal the weight of the machine. A small percentage of dirt in this air will, therefore, cause trouble if oil or moisture is present. Dry dust is not so dangerous. Tests of air washers used with large generators at East Pittsburgh show that machines which formerly would become completely clogged within six months, now, through the use of air washers, can be operated for that period with scarcely any accumulation of dirt. Mr. Lamme also expressed a decided preference for mica insulation rather than fibrous insulation.

Public Service Commission News

New Jersey Commission

In denying the application of the Commonwealth Water Company to increase its schedule of rates at Summit and vicinity, the Board of Public Utility Commissioners has issued a statement defining its views in general to agreements between public utilities and municipalities with regard to taxation, as follows:

"This board does not look with favor on any attempt to adjust the rates to be charged by a public utility company on a bargain or dicker between the utility company and the municipality based on an agreement as to what shall be or shall not be the assessed valuation of the company's property for taxing purposes. If there is any improper or unjust assessment levied against the company the tax act provides proper and ample method of relief."

Pennsylvania Commission

Rule 28 of the practices before the Public Service Commission has been amended so that applications for certificates of public convenience to approve the authorization of one public service company to lease, purchase or jointly use telegraph, telephone or electric light poles belonging to another public service company, or to approve the lease or purchase of a building or portion thereof, may be made without prior notice by publication unless otherwise ordered by the commission, provided, however, that of each and every application ten days' actual notice in writing shall be given to the proper authorities of the municipality wherein such poles, or buildings are located of the time and place of making such application, and of which notice proof shall be filed with the commission. The construction, clearance and maintenance of wires on poles must at all times fully comply with the engineering requirements of the commission.

Must Pay Full Incorporation Tax for Extension of Corporate Existence.—In an opinion handed down by Judge Revelle in the Missouri Supreme Court on Nov. 29, Secretary of State Roach was sustained in his position that the Kinloch Telephone Company of St. Louis must pay the full tax the same as if newly incorporated for an extension of thirty years of its corporate existence. Judge Revelle's ruling is concurred in by all of the judges except two, who dissented.

Tacoma Expects to Enlarge Municipal System.—Superintendent Evans of the Tacoma (Wash.) Municipal Lighting Plant, is investigating sites for a new hydroelectric power plant, as he reports to the Council that the maximum of the present municipal plant at La Grande will be reached in 1921. The City Council believes an addition to the system should be started now, as it will take at least three years to build a duplicate of the present plant, and would cost about $2,000,000.

Report of Federal Trade Commission on Foreign Trade Combinations.—The Federal Trade Commission has issued the full text of its report on "Co-operation in American Export Trade." It is an extensive report in two volumes, and is the result of an investigation which was made by the commission into trade conditions in and with foreign countries where associations, combinations or other conditions affect the foreign trade of the United States. One section of the report deals with electrical apparatus and supplies and describes the export combinations and agreements affecting manufacturers in these industries in Great Britain and Germany

Memorial Service for Late A. C. Einstein.—A joint public memorial service in memory of A. C. Einstein, late vice-president and general manager of the Union Electric Light & Power Company, St. Louis, Mo., who died on Nov. 20, was held last Sunday in Temple Shaare Elmeth. Those who delivered addresses were Mayor Kiel, representing the city; General E. J. Spencer for the Jovians; Louis P. Aloe for the Columbian Club; Rev. J. W. Lee as "neighbor and friend"; A. P. Greensfelder, representing the Engineers Club; H. J. Pettingill for the St. Louis public utilities; Herman Spoehrer for the Union Electric staff, and former Judge Caulfield, representing the Mercantile Club and the Coliseum Company.

Price and Delivery of Coal Forces Power Company to Discontinue Service—The Dunkirk (N. Y.) Power & Heating Company has notified its power consumers that it will discontinue electric service early in December owing to the high cost of soft coal and the difficulty in obtaining a supply in large quantities. Some consumers suggested that A. W. Cummings, president of the company, call a meeting with a view of having them agree upon a rate increase, but the company declared it would retire from business. The company has been supplying direct current, and consumers will be forced to change their motors in order to handle other power.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Columbus Municipal Plant Establishes a 6-cent Rate.—Mayor Karb of Columbus, Ohio, on Nov. 29 signed the ordinance governing the service rates for the municipal plant. It provides for a rate of 6 cents per kilowatt-hour with a discount of 1 cent if bills are paid by the 10th of the month. Rates are also provided for commercial lighting and power. The plant, however, cannot furnish energy until extensions are completed.

Brooklyn Edison Service Replaces Isolated Plants.—A contract was signed recently by the Brooklyn Edison Company with the Chelsea Fiber Mills for 4000 hp. This is an original order, and replaces a very efficient private steam plant. Edison service is to be used in the manufacture of textiles in this plant, which business will yield a revenue of approximately $75,000 a year to the power company. Also a contract was closed with the H. Batterman Dry Goods Store, one of Brooklyn's largest stores. This was one of the few remaining private plants in a dry goods store in Brooklyn. It was practically new and efficiently operated. The contract is for 500 hp. in lights and motors.

City Engineer Recommends that Seattle Abandon Sauk-Suiattle Power Site.—A recommendation was recently made to the Seattle (Wash.) utilities committee of the Council by City Engineer A. H. Dimock, recommending that the Council abandon the idea of developing the Sauk-Sniattle power project, as an adjunct to the municipal plant. Engineer Dimock made his recommendation following the receipt of a query from the Forestry Service at Portland, Ore., asking for information regarding what the city of Seattle intended to do relative to the development of the project. The American Nitrogen Products Company has expended upwards of $25,000 in investigating the project and is reported to have money available for the immediate development of the site. The company, it is stated, plans the expenditure of at least $25,000,000 in a plant for the manufacture of nitrogen products, in case it can obtain full rights from the government. It is stated if the city of Seattle does not develop the Sauk-Suiattle site, the American Nitrogen Products Company will do so. As certain members of the Council seem loath to abandon the plan of development, City Engineer Dimock has been directed to make a report to the Council in writing, transmitting at the same time the correspondence from government officials in relation to the acquisition of the power site.

Christmas Lighting Decorations.—Plans have been made by the Retail Merchants Association of Ottumwa, Iowa, for decorating the streets with Christmas trees and electric lights during the days preceding Christmas, with the view of attracting people to Ottumwa for their Christmas shopping. Energy will be furnished as in previous years by the Ottumwa Railway & Light Company.

Union Electric Again Reduces Rates.—Announcement has been made by the Union Electric Light & Power Company of St. Louis, Mo., that the customers of the company had reached a total of 75,000 and that the promised rate reduction from 8.5 to 8 cents a kilowatt-hour in the company's schedule, affecting the residence and smaller commercial consumers in St. Louis, would become effective on Dec. 1. The reduction will mean a saving annually of about $66,000 to the residence customers and $90,000 to the smaller commercial customers. The reduction was a part of a program announced on Aug. 13, 1915, for the reduction of rates as the customers of the company increased. On Dec. 12, 1915, when the customers of the company reached a total of 65,000, the rates affected were reduced from 10 to 9 cents, and on June 15, 1916, when the customers had increased to 70,000, they were reduced from 9 to 8.5 cents. Further rate reduction will be made as the business of the company increases. It is stated by the officers of the company that the wiring of many old houses is responsible for a greater part of the last increase to customers.

Purchase of Alaskan Company Ends Long Rate War.—The recent purchase of the Illes Hydro-Electric Company of Valdez, Alaska, by the Prince William Sound Water, Power, Light & Telephone Company, a Seattle corporation, for approximately $100,000, brings to a close a rate war which has disturbed the residents of that district for nearly four years. The Prince William Sound Company, organized in December, 1915, was virtually a consolidation of the old Alaska Water, Light & Telephone Company and the Valdez Electric Company. Four years ago the company decided to build its own hydroelectric plant at a cost of $70,000, on a site obtained from the government. Formerly, the company leased its water power from the Illes plant. Following this movement, the Illes Company organized a consumers' company under the name of the Valdez Electric Company, and a rate-cutting war ensued, until the Valdez Electric Company was taken over by the Alaska Water, Light & Telephone Company. The Prince William Sound Water, Power, Light & Telephone Company was then organized, and the affairs of the Alaska Company were placed in charge of a committee of Seattle stockholders. The Prince William company, besides furnishing lighting, power and heat for Valdez, Fort Liscom and other points in that district, owns and operates the telephone system for the entire section. Both plants will be operated for the time being, but eventually the two plants will be consolidated.

Trail Electric Club Formed.—An electric club has been formed at Trail, B. C. F. A. Snidel is secretary.

Meeting of Georgia Electrical Contractors.—A meeting of the Georgia Electrical Contractors' Association was held at Columbus, Ga., on Nov. 21.

Pacific Service Section, N. E. L. A.—The semi-monthly meeting of the section was held in San Francisco Nov. 28. R. A. Murray of the Great Northern Railway gave an illustrated lecture on "Glacier National Park."

Supply Jobbers' Meeting.—A meeting of the central division of the Electrical Supply Jobbers' Association will be held at the Hotel La Salle, Chicago, on Dec. 12. The next general meeting of the association will be held at Hot Springs, Va., in May, 1917.

Detroit Engineering Society.—At the last meeting of the society L. H. Baekeland, of the Bakelite Company of America, spoke on "Synthetic Resins and Their Uses in Electrical Engineering and Automobile Engineering." It was a joint meeting with the Detroit chemists.

Meeting of G. E. Alumni Association.—E. F. Collins, technical superintendent of the General Electric Company, addressed the meeting of the General Electric Alumni Association of the Apprentice Training System on Dec. 8 on the subject: "Some Applications of Electricity to Industrial Heating."

Los Angeles Section, A. I. E. E.—At the regular November meeting officers were elected for the ensuing year as follows: Chairman, R. H. Manahan; secretary, Carl E. Johnson; chairman of papers committee, H. A. Barre; directors, J. A. Lighthipe, Edward Woodbury, R. A. Morehead and F. W. Harris.

Officers of Northern Illinois Public Service Section, N. E. L. A.—The officers for the Public Service Company of Northern Illinois Section of the National Electric Light Association are as follows: Chairman, George R. Jones; vice-chairman, F. E. Williams; secretary, C. R. Bennett; and treasurer, H. L. Caldwell.

Dalas Club Hears About Pacific Coast Development.—F. H. Rosencrants, engineer for the Texas Power & Light Company, who has just returned from a visit to the Far West, addressed the members of the Dallas Electric Club and Jovian League on Nov. 24 on "Electrical Development on the Pacific Coast."

I. E. S. Lecture Course Reprints.—The reprints of the Illuminating Engineering Lecture Course recently held at the University of Pennsylvania, it is hoped, will be available shortly after the first of the year. Members of the society may obtain copies of these reprints at a reduced price, not to exceed $5, provided the orders are received prior to the date of publication. This price will be cost plus delivery and handling expenses, without any profit to the society. All orders for these reprints should be sent to Clarence L. Law, Irving Place and Fifteenth Street, New York City.

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next-to-last text page.

Electrical Development and Jovian League of San Francisco.—At the regular weekly luncheon, on Nov. 22, the principal speaker was J. G. Kasai, a prominent Japanese lecturer and writer on international affairs.

Institute of Radio Engineers.—A San Francisco Chapter of the Institute of Radio Engineers was organized in that city on Nov. 21. The officers elected were, chairman, W. W. Hanscom, and secretary-treasurer, V. Ford Greaves, who with H. G. Aylsworth make up the executive committee of the chapter. Regular monthly meetings will be held by the new chapter.

Associated Manufacturers of Electrical Supplies.—Invitations have been issued by the general secretary of the association to the manufacturers of attachment plugs and baseboard receptacles to attend a meeting on Dec. 12, at the Hotel Biltmore, New York City, for the purpose of organizing a section in the association covering this particular line of the industry. There have been a number of requests made for a Section covering these devices, and invitations to attend the meeting have been extended to all manufacturers, whether members of the association or not. The regular meeting of the board of governors of the Associated Manufacturers of Electrical Supplies will be held at the offices of the association, 62 Cedar Street, New York City, on Dec. 20.

San Francisco Section of Institute Studies Insulator Experiments.—The San Francisco Section of the A. I. E. E., at the regular meeting on Nov. 24, listened to a series of three papers on insulator studies. The first, "Investigation of Suspension Insulator Deterioration by California Power Companies," by J. E. Woodbridge and J. P. Jollyman, explained the plan whereby four California power companies are co-operating with Stanford University in exhaustive tests of high-tension insulators carried on with a practical purpose in view. J. C. Clark presented a progress report describing the apparatus used in the laboratories and the results accomplished thus far. Prof. Harris J. Ryan read a paper on "A Study of Ceramics of Insulators," in which he emphasized the urgent need for a material more refractory than porcelain. On the following day the section went to Stanford University, examined the apparatus, and saw some of the tests.

Institute of Radio Engineers.—A meeting was held on Dec. 6 at the Engineering Societies Building, New York City, when a paper on "The Classification and Elimination of Strays," by Dr. C. J. deGroot, head of the Radio Service of Holland in the Dutch East Indies, was presented.

New York Jovian Electrical Week Meeting.—A meeting in celebration of America's Electrical Week was held on Dec. 6 by the Jovian Electrical League of New York City. James H. McGraw, president of the McGraw Publishing Company, presided. Mr. McGraw commented on the scope of the Jovian order, pointing out its strong national character but local weakness. He said that the ideal of Jovianism is the constructive effort of the electrical industry. J. M. Wakeman, general manager of the Society for Electrical Development, told how America's Electrical Week had been planned and worked out and how Jovians had co-operated to make the movement a national as well as a local success. He also pointed out that the movement was conducted in a manner that worked for a closer bond of friendship and co-operation between the separate branches of the industry. The Rev. C. Wallace Petty was the last speaker. He emphasized the need of idealism in business.

Electric Vehicles in City and Postal Transportation Service.—To place in the hands of the municipal officers, postmasters and central station managers of every town and city of importance in the United States definite and authoritative information on the use of electric vehicles in municipal and postal transportation, the N. E. L. A. committee of which James H. McGraw is chairman, is preparing to issue a booklet which, in attractive form, will tell the story of the splendid achievement of the "electric" in the field of city transportation service. Plans were outlined to put the leaders of the electrical industry squarely behind the electric vehicle in a way not before accomplished, and the importance of educating the central station and the public to the merit of the "electric" was especially emphasized. Along this line, Charles A. Ward proposed inaugurating a publicity campaign calling for the expenditure of $100,000 to $250,000 in the interests of the electric vehicle. In any such publicity campaign, the co-operation of the central stations was declared to be of the greatest importance. A proposal to maintain an experienced electric vehicle man in Washington to demonstrate to government officials and department heads the merits of the "electric" was also taken up for consideration. Much interesting experience with electric fire trucks was recounted by the manufacturers, showing the great development for this class of apparatus. Mr. McGraw's committee will also co-operate in securing wide distribution for the new motion-picture film showing electric fire apparatus in service, which has just been completed and presented to the N. E. L. A. Information for the forthcoming booklets on electric trucks in government service is now being collected by a sub-committee having the matter in charge under the direction of Nelson F. Carle of the General Vehicle Company.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

INCREASED DEMAND FOR SEARCHLIGHT OUTFITS

Military Activities and Maritime Requirements Call for a Large Number of Portable Gasoline-Electric Sets

For some time there has been an unsatisfied demand for portable gasoline-motor-electric generator searchlight sets for military and maritime purposes. Particularly has the demand been large from all European countries whether at war or not. Scandinavian manufacturers have secured contracts for a considerable part of this demand, but there is still a large market. American manufacturers have secured contracts for a large number of 12-kw. and larger machines for delivery to Russia, Spain and other European countries.

The United States government has also been in the market for portable searchlights for border service. These sets, which are larger than those for European service, are mounted on automobile trucks.

Besides this use in field military service, the increased amount of new shipbuilding has called for a larger number of portable searchlights of a smaller rating.

COPPER ABOVE 35 CENTS

Prices Advance Half a Cent for All Deliveries—Fourth Quarter 1917 Metal at 30.75 Cents

Copper continues to advance in price, and the predictions of the Electrical World that electrolytic would reach 40 cents before the close of 1916 seems nearer fulfillment. Monday of this week saw the passing of the 35-cent mark, and on Tuesday the metal was nominally quoted at 35.25 cents for December delivery. For January delivery the same price was quoted.

For first quarter delivery a nominal quotation of 34.25 cents was made, and a cent lower for second quarter. Third quarter was quoted at 31.25 and fourth quarter at 30.75 cents.

Copper wire was quoted on Tuesday at 40.50 for prompt delivery, and at 39.25 for January delivery. These prices are strictly nominal, and it is doubtful if any wire could be obtained for these deliveries at the above prices.

STANDARD CATALOG SIZES

Tendency Appears to Be Toward Eventual Adoption of 8.5-In. by 10-In. Page

For some time there has been among the electrical trade an agitation toward standardization of catalog sizes. Nothing really definite has as yet come to pass but there seems to be a clearly marked tendency in a certain direction. Until quite recently the 6-in. by 9-in. catalog was probably used more than any other size by electrical manufacturers. This size has not proved to be the most convenient, especially when the catalog size is to be standard for all other sales literature.

Had all manufacturers, however, used a standard 6-in. by 9-in. page it is doubtful if any change would be demanded. But now when there are so many different sizes issued and especially when a single manufacturer will not always use the same size, the buyer's collection of catalogs has a very untidy look, aside from the waste of shelf space.

Following the lead of some of the larger manufacturers and some of the national commercial associations electrical manufacturers are turning toward the 8.5-in. by 10-in. page. In fact, there seems to be good reason for belief that this size of catalog will gradually supersede the more common 6-in. by 9-in. size and eventually become the standard size for catalogs of electrical supplies.

PLAN FOR CO-OPERATIVE BUYING OF ELECTRIC TRUCKS

Idea Conceived by the N.E.L.A. Whereby Central Stations Receive Special Discounts from Manufacturers' List Prices

There was put into effect this week by one of the large manufacturers of electric trucks a co-operative buying plan whereby central stations may receive special discounts from the list price determined by the cumulated central-station purchases within a given time. This is the first of the plans for special discounts to be made public. The other manufacturers, it is understood, have signified their willingness to offer a special discount to central stations. Plans of some of the other manufacturers which are now in the process of being formulated are expected to be disclosed soon. What form these other plans will take is not known, but certain of the manufacturers have expressed the opinion that a flat discount would be very favorable to them.

The movement for a special discount was conceived by the National Electric Light Association and had its inception at the Chicago convention of the association last May, when President Herbert A. Wagner, speaking on the subject "Central-Station Co-operation," urged upon member companies and manufacturers the necessity of close co-operation if, as he has expressed it, "we are to hope to bring the electric vehicle to the position in transportation methods which its inherent merits justify." As a result there was appointed the manufacturers and central-station co-operation committee, of which G. B. Foster of the Commonwealth Edison Company is chairman. This committee suggested that a material evidence of co-operation on the part of manufacturers would be the granting to central stations a special discount.

No definite plan was made by this committee, its activity on this point being confined to convincing electric-truck manufacturers of the wisdom of the movement.

The first plan to be made public, that of the General Vehicle Company of Long Island City, is based on the collective buying of the central stations. A series of price classifications have been worked out ranging from A to H, each price classification covering the price per chassis which will be effective in the event of the total number of chasses ordered under this plan reaching the numbers given as the limitation of each classification.

Classification A: If the total number of chasses ordered hereunder does not exceed ten.

Classification B: If the total number of chasses ordered hereunder exceeds ten but does not exceed twenty-five.

Classification C: If the total number of chasses ordered hereunder exceeds twenty-five but does not exceed fifty.

Classification D: If the total number of chasses ordered hereunder exceeds fifty but does not exceed seventy-five.

Classification E: If the total number of chasses ordered hereunder exceeds seventy-five but does not exceed 100.

Classification F: If the total number of chasses ordered hereunder exceeds 100 but does not exceed 150.

Classification G: If the total number of chasses ordered hereunder exceeds 150 but does not exceed 200.

Classification H: If the total number of chasses ordered hereunder exceeds 200.

This plan is to run for a period of three months, opening Dec. 1, 1916, and closing Feb. 28, 1917, but the company retains the right to close it at any time prior to Feb. 28 if in its judgment such action seems necessary or desirable.

This plan covers the company's standard chassis with battery and, when so specified, the extra chassis equipment of ampere-hour meter or winch, but does not cover bodies. "It is not practical," the company states, "to attempt to furnish bodies on a co-operative buying plan as broad as the present one, and participating companies will find it more satisfactory to have their bodies built locally for the following reasons:

"1. The purchaser will save transportation charges by having the chassis shipped without body.

"2. Purchasing bodies locally will encourage home industry and build a certain amount of local pride into the complete vehicle.

"3. Practically every purchaser will desire some modification from our standard body types, and these special bodies can more easily be supplied by a local body builder."

The company states that up to Dec. 1 it has received advance assurances of sufficient orders under the plan to warrant it in guaranteeing a maximum price of classification D.

CONTRACTORS AS CREDIT RISKS

Wiremen Wishing to Have Business of Their Own Present Greatest Problem

In point of numbers if not in point of quantity electrical contractors are the greatest buyers of electrical supplies. Most of their buying is done through jobbers, so that the manufacturers as a rule have few dealings with the contractors. To the jobber, however, the contractors represent the largest single buying power and incidentally the largest credit risk. The ratio of losses by contractors to the total losses is apt to be much larger than the ratio of contractors' accounts to the total business booked. One jobber has estimated his contractors' accounts to be 45 per cent of his business, while the credit losses from contractors are around 70 per cent of the total losses.

There are two reasons that will probably account for most of the losses. Some jobbers in slack seasons are not careful enough in granting credit, and where careful enough the contractor had failed owing to mismanagement or sickness. Risks must be run, of course, but they should be taken sanely. Most contractors enter the trade from the wiremen's ranks. They save up a little capital and then embark in business. When they come to buy their stock it will generally be found that the capital saved up is insufficient and if sufficient is barely so leaving practically no funds to live on while the business is getting on its feet.

These men are the real problem of the credit managers. If refused credit the business is nipped in the bud and another possible outlet for supplies is forever gone. If the credit is too long it is apt to breed carelessness, if too great it is apt to prove too much for the contractor to carry when the account falls due.

More successful credit managers, and by that is meant those who take the maximum risk with the minimum loss, are taking a middle ground. Provided a contractor just starting out can satisfy the credit man that he knows electrical contracting, is responsible, has definite headquarters, he will generally get credit commensurate with what he has saved up. Sometimes even if the contractor is able to invest nothing in stock the credit man will take a small risk provided the contractor satisfies him as to his responsibility in the other ways.

In granting this credit the credit man must be liberal enough to satisfy ordinary conditions of trade. He must extend credit enough to cover a fairly comprehensive stock, otherwise the contractor will spoil everything by obtaining a small credit from more than one place and so divide his responsibilities. In this case the credit man will fix a certain amount as the credit limit and suggest that the sales department buy the stock with this credit.

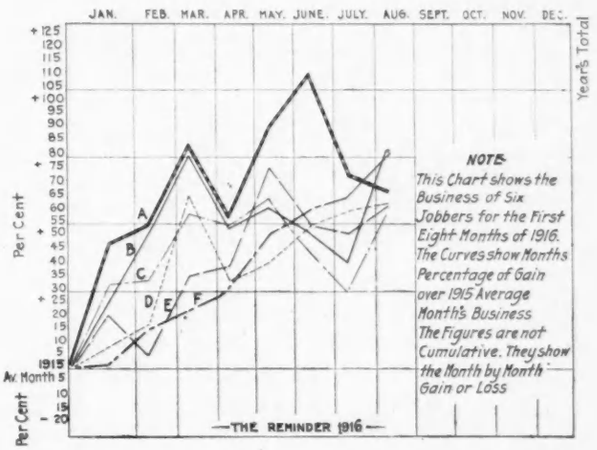
Some jobbers have "stock" stocks. Thus a $500 credit risk will get stock "C" for instance; $1,200, stock "F," etc. The reason for this is that the contractor will have a well-balanced stock. He will not have too much of one thing and too little of another. Under such a plan the losses in proportion to the risk taken have been found to be small.

JOBBING BUSINESS FAR AHEAD OF LAST YEAR

Chart Prepared by Electric Supply Jobbers' Association Shows Monthly Gain in Per Cent for First Eight Months of 1916 Compared with 1915

In the current issue of the *Reminder*, the official bulletin of the Electric Supply Jobbers' Association, there is contained a chart, reproduced herewith, showing the monthly percentage gain in the business of six jobbers during the first eight months of 1916 compared with 1915. The figures are not cumulative.

A study of the curve shows the same general conditions to be true for each jobber for practically every month. The general trend is upward. There is a perceptible peak in March followed by a valley in April and by another and greater peak in June, after which the rate of increase falls off with a tendency to recover in August. These curves


JAN. FEB. MAR. APR. MAY. JUNE. JULY. AUG. SEPT. OCT. NOV. DEC.
Per Cent
Year's Total
1915 Av Month
Per Cent
A
B
C
D
E
F
NOTE-
This Chart shows the Business of Six Jobbers for the First Eight Months of 1916. The Curves show Months Percentage of Gain over 1915 Average Month's Business The Figures are not Cumulative. They show the Month by Month Gain or Loss
—THE REMINDER 1916—

MONTH BY MONTH INCREASES IN JOBBING BUSINESS

were compared by the ELECTRICAL WORLD with that of another jobber and it was noticed that the curve of this jobber followed the trend shown in the chart rather consistently. The curves, it must be borne in mind, do not show volume of business but only the percentage gain over 1915. It must not be considered as a seasonable chart.

In an endeavor to translate the curves to discover the conditions that led to the characteristics shown on the chart it was found that the 1916 volume of business was consistently large, and increased month by month without any valley in April, as shown in the chart. On the other hand, the 1915 business, with the exception of that late in the year, was poor, especially that for January, February and March. April, however, in comparison with the preceding and succeeding months, showed a tremendous increase. For that month alone business took a leap. Therefore, although April, 1916, was an excellent month, it shows up to disadvantage on the chart because it is compared with the best early month in 1915. Had April, 1915, been but an ordinary month, such as those immediately before and after, then the 1916 curves would have no inflection until the month of July.

In July the uncertainty of the harvest combined with a strong feeling that crops would not approach those of 1915 in quantity lead to a diminution of sales by jobbers. It is quite probable that this factor was responsible for the July slump in the chart.

The last three months of 1915 were notable in the electric jobbing business. The business for the period mentioned was so large that there will undoubtedly be but little difference between that volume and the volume of the last quarter of the current year.

Manufacturing and Industrial

Horace N. Trumbull has been appointed advertising manager of the S K F Ball Bearing Company of Hartford, Conn.

Minato Hongo Company, 154 Nassau Street, New York City, exporters, has established an exporting department of electrical machinery and mechanical instruments.

Universal Motor Company, Oshkosh, Wis., is advising customers of an increase in price, to go into effect Jan. 1. Future dating on shipments under regular terms may be had up to May 1.

Page & Hill Company, Minneapolis, Minn., dealers in poles, announces the appointment of Bulford Adams of Kansas City, who has long been identified with the telephone field, as sales manager.

Edison Lamp Works of the General Electric Company, Harrison, N. J., is erecting new office quarters at the factory. When the building is completed the present offices will be turned over to factory space.

Prohibit British Manufacture of Copper Wire.—The British minister of munitions has issued an order prohibiting the manufacture of any copper wire or any cable containing copper, except for government purposes.

Hurley Machine Company announces the purchase of 100 000 sq. ft. of land located at Taylor Street and Campbell Avenue, Chicago. Ground will be broken immediately for a factory with a capacity of 1000 Thor machines daily.

J. B. Hill, W. E. Schwob and H. G. Miller announce the organization of the Schwob-Miller Engineering Company, to engage in a general practice as consulting and designing engineers, with offices in the Phoenix Block, Iowa City, Iowa.

Greusel-Quarfot Electric Company purchased on Dec. 1 the wholesale electric supply business of the C. J. Litscher Company, Milwaukee, Wis. Frank W. Greusel is president of the new company and Ernest A. Quarfot is secretary and treasurer.

The Terry Steam Turbine Company of Hartford, Conn., announces the appointment of Stephenson & Nichols, Monadnock Building, San Francisco, Cal., as their representatives in Northern and Central California and the northern part of Nevada.

K. McLennon & Company, Chicago, has moved its offices from 102 North Fifth Avenue to 1751-59 West Thirty-fifth Street. The facilities for the manufacture and sale of Gales Commutator Compound have been very materially improved in the new location.

Black & Decker Manufacturing Company, Baltimore, Md., has purchased a tract of land on the outskirts of Baltimore along one of the railroads, consisting of about 10 acres. While the company is not yet ready to build, President S. Duncan Black says that the demand for electric tire inflators and for electric drills is increasing so rapidly that it will be necessary to build a new plant on this property to take care of this line of business.

The Connecticut Electric Manufacturing Company announced Dec. 1 that, owing to continued advances in raw material, it withdrew all previous prices on goods of its manufacture. New quotations, effective Dec. 1 will be furnished upon application, subject to change without further notice. All orders received on and after this date will be accepted at prevailing prices at time of receipt of order. No blanket or future orders will be accepted.

The Westinghouse Machine Company of East Pittsburgh, Pa., reports the following recent orders for complete equipments of turbines, gears and condensing apparatus for ships now in construction: Chester Shipbuilding Company, one 2500-S.H.P. set; Skinner & Eddy Corporation, one 2500-S.H.P. set; Ames Shipbuilding & Dry Dock Company, three 2500 S.H.P. sets; Baltimore Dry Docks & Shipbuilding Company, two 1800-S.H.P. sets. In addition an order has been received from the Moor & Scott Iron Works for three 2500-S.H.P. sets, including turbines and gears.

Electric Truck Sales Continue to Increase.—Notwithstanding the price of raw material, freight embargoes, and the ever uncertain labor situation, A. P. Bourquardez, sales manager of the General Vehicle Company, reports that sales during the last thirty days have exceeded his expectations. The number of initial order sales—that is, those involving firms which have never before bought an Electric truck—is very gratifying. Among these sales are a number to lighting companies, the Milwaukee Electric Railway & Light Company, Illinois Traction Company, Texas Power & Light Company, and Pacific Power & Light Company.

Contract Awarded for New Wagner Factory.—A contract has been awarded for a new building in the Wellston plant group of the Wagner Electric Manufacturing Company. The company will employ 1000 additional persons in this new building. Other plant construction in contemplation may increase the working force about 1000 more. The new building will be five stories in height, covering 60 ft. by 400 ft. The floor area will be 140,000 sq. ft. Ground has been broken, and the building, it is expected, will be finished by March 15, 1917. The company will manufacture standard electrical products in the new building.

Australian Export Practices and Regulations.—A publication, very apropos in view of the more or less disturbed conditions obtaining in trade with Australia at the present time, is Commercial Attaché Philip B. Kennedy's "Exporting to Australia." In this little work Mr. Kennedy discusses the practices and regulations to be observed by American shippers with reference to packing, insurance, documentation, postage, parcel-post and express, correspondence, traveling representatives and taxation affecting foreign merchandise. In an appendix forms are included of the statutory declaration by the exporter, requisition for document credit, letter of credit and also the Trade Descriptions Act of 1905 with the regulations thereunder. Copies of this publication may be obtained from the Bureau of Foreign and Domestic Commerce at Washington.

Pole Company Increases Service to Customers.—The Paducah (Ky.) Pole & Timber Company, a producer of chestnut poles, has devised a plan for preparing poles ready for erection upon their arrival at the purchaser's yards. The company proposes to shave its poles from top to bottom, to dress down the knots, and to gain, bore and roof the poles in its yard. When they have been seasoned the pole butts will be subjected to an open-tank treatment for fifteen minutes in preservative at a temperature of 70 deg. Fahr. When the poles are removed from the tanks they will be given a brush treatment over that portion not covered by the preservative in the tanks. It is the company's purpose in undertaking to perform this additional service to relieve utility companies from doing that part of pole-line construction, which can be done more cheaply, and perhaps better, by the pole producer. Efficient labor for shaving, gaining, boring and roofing poles can be obtained at the producer's yards at about $1.50 per day per man. When linemen are employed to do this work in utility companies' yards the labor cost, it is claimed, is usually from $3 to $3.50 per day per man. The idea in giving the poles a combination open-tank and brush treatment is that poles which are to be sawed off and "set down" after doing some service at their original height, will give enough increased life to justify the slight additional expense.

NEW YORK METAL MARKET PRICES

	Nov. 27 Selling Prices Bid	Nov. 27 Selling Prices Asked	Dec. 5 Selling Prices Bid	Dec. 5 Selling Prices Asked
Copper	£ s d		£ s d	
London, standard spot	147 0 0		152 0 0	
Prime Lake	33.50 to 34.00†		33.75 to 34.25†	
Electrolytic	33.75 to 34.25†		35.00 to 35.50†	
Casting	32.25 to 32.50†		33.00 to 33.50†	
Copper wire base	40.00†		40.00†	
Lead	7.00		7.50	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	21.00		21.00	
Spelter, spot	13.05 to 13.30		12.67½ to 12.92½	
Tin, straits	45.50		44.50	
Aluminum, 98 to 99 per cent.	58.00 to 60.00†		58.00 to 60.00†	

OLD METALS

Heavy copper and wire	28.00 to 29.00†		27.00 to 28.50†
Brass, heavy	16.00 to 17.00†		16.00 to 17.00†
Brass, light	12.50 to 13.00†		13.00 to 13.25†
Lead, heavy	6.25 to 6.50†		6.50 to 6.62½†
Zinc, scrap	8.50 to 9.00†		9.00 to 9.25†

COPPER EXPORTS

Total tons to Dec. 5 3,489

†Nominal.

Corporate and Financial

Central Power Company, Canton, Ohio.—Under this new name the Canton Electric Company has been authorized by the Ohio Public Utilities Commission to purchase the properties, franchises and assets of the Ohio Light & Power Company and the Sunnyside Electric Company. The Central company has been further authorized to issue $2,700,800 of its common stock, $991,900 of its preferred stock, and not more than $5,960,000 of its new first and refunding mortgage bonds, and that of these not more than $3,024,000 are to be sold for not less than 85, to realize the sum of $2,570,177.40. It was also ordered that the common and preferred capital stocks and bonds, or the proceeds arising from the sale thereof, be devoted to the following purposes: (a) $2,250,000 common stock, $250,000 preferred stock, and $1,436,000 of bonds, to be exchanged at par for the present outstanding common and preferred stocks and $1,406,000 bonds of the Canton Electric Company and the $30,000 bonds of the Canton Light, Heat & Power Company, and the proceeds arising from the sale of $339,000 of the bonds used to pay the $288,008.25 indebtedness of the Canton Electric Company, incurred to March 31, 1916, in the construction of its plant and facilities. (b) $440,600 common stock, $741,900 preferred stock, and $1,500,000 bonds to be exchanged for the present outstanding $500,000 common stock, $741,900 preferred stock, and $1,500,000 bonds of the Ohio Light & Power Company, and the proceeds arising from the sale of $1,723,500 of bonds used to pay the $1,464,850.24 indebtedness of the company incurred in the construction of its plant and facilities. (c) $10,000 common stock, to be exchanged at par for the outstanding common capital stock of the Sunnyside Electric Company, and the proceeds arising from the sale of $961,500 of bonds used to pay the $817,318.81 construction indebtedness.

Consolidated Cities Light, Power & Traction Company, New York, N. Y.—A syndicate is being formed to sell $3,000,000 of the first lien 5 per cent gold bonds, due July 1, 1962, of the company, heretofore owned by Cities Service Company. In 1912, $7,000,000 of these bonds were sold in England, making the total amount of issue $10,000,000. The bonds will be sold to investors at 92.5 to yield about 5.5 per cent.

Detroit (Mich.) Edison Company.—An issue of $1,500,000 of 5 per cent first and refunding mortgage gold bonds due July 1, 1940, is being offered at 101.5 and interest.

Massillon (Ohio) Electric & Gas Company.—A new issue of $540,000 (or less) of first mortgage 5 per cent sinking fund gold bonds due July 1, 1956, is being offered at 97.5 and interest. In a letter to the purchasers of the bonds President Henry L. Doherty said: "To provide for future growth, the Ohio Public Utilities Commission has authorized the company, (a) to create this issue, authorized $2,000,000, and to issue forthwith sufficient to retire the existing practically closed first mortgage issue, dated Jan. 2, 1908, and also, (b) to sell $125,000 of 6 per cent cumulative preferred stock, the proceeds to be utilized in reimbursing it for investments in the property already made, and against which no bonds had been issued."

Pacific Gas & Electric Company, San Francisco, Cal.—The directors of the company expect to take possession of the Oro Electric Corporation about Jan. 1. The properties, it has been stated, were secured for around $1,600,000, and it is expected that the revenue received from them will increase the net earnings of the parent company about $160,000 next year.

Springfield (Ohio) Terminal Railway & Power Company.—An offering of $250,000 of first mortgage 6 per cent serial gold bonds of 1916 is being made at 101 and interest.

United Light & Railways Company, Grand Rapids, Mich.—A new issue of $1,500,000 of 6 per cent convertible gold debentures due Nov. 1, 1926, is being offered at 99 and interest.

Northern Ohio Traction & Light Company, Akron, Ohio.—Following the acquisition of the company through stock control by the Northern Ohio Electric Corporation, a new board of directors and new officers were elected. The new officers are: President, B. C. Cobb; vice-presidents, J. C. Weadock and T. A. Kenney; vice-president, treasurer and general manager, A. C. Blinn; secretary, F. C. Potwin.

New Utility and Industrial Companies

The Cleveland (Ohio) Electric Motor & Manufacturing Company has increased its capital stock from $10,000 to $45,000.

The Cincinnati (Ohio) Storage Battery Company has been incorporated with a capital stock of $30,000 by A. H. Luhrman, W. T. Foley, E. M. McDonald and others.

The Crown Gas & Electric Fixture Company of Milwaukee, Wis., has been incorporated with a capital stock of $20,000 by Emil Dietz, Frank A. Lofy and Joseph J. Arnheim.

The Bunker Hill Electric Company of Myerstown, Pa., has been organized by S. R. Rothermel, D. S. Martin and Adam Albright. The company is capitalized at $5,000 and proposes to supply electricity in Jonestown.

The Kansas City Chandelier Company of Kansas City, Mo., has been incorporated by Albert Jacobson, Jacob Lebrecht and Irvin Jacobson. The company is capitalized at $12,000 and proposes to manufacture gas and electric fixtures.

The Jackson County Transmission Company of Brownstown, Ind., has been incorporated by Earl F. Reasan, Frederick G. White and Wilfred Jessup. The company is capitalized at $15,000 and proposes to supply electricity for light, heat and power.

The Powersville (Mo.) Electric Light & Power Company has been incorporated with a capital stock of $3,000 by I. O. Pollock, G. H. Scott and J. W. Rowan. The company proposes to supply electricity for lamps and motors in Powersville and vicinity.

The Orange (N. J.) Electric Garage Company has been incorporated with a capital stock of $50,000 by W. Carver of East Orange; J. A. Savage, Jr., and A. E. McGeehan of Newark, N. J. The company proposes to do a general automobile business in Orange and East Orange.

The Vital Utilities Corporation of New York, N. Y., has been incorporated with a capital stock of $25,000 to deal in electric and mechanical vacuum cleaners, house utensils and office specialties. The incorporators are: J. J., M. J. and J. F. Walsh, 364 East 198th Street, New York, N. Y.

The Lakeview Electric Company of Milo, Me., has been organized with a capital stock of $5,000 to construct and operate an electric-light plant in Lake View plantation and the town of Brownville. The officers are: E. M. Hamlin, president; W. O. Harvey, treasurer, and R. W. Johnson, clerk, all of Milo.

The National Motor Car & Vehicle Corporation of New York, N. Y., has been chartered with a capital stock of $800,000 by W. Shirden, R. S. Dodge and J. R. Lindemuth of 122 East Thirty-sixth Street, New York, N. Y. The company proposes to deal in vehicles, motors and power generators of all kinds.

The Antrim-Bennington Electric Light & Power Company of Concord, N. H., has been chartered by Louis N. Wheelock of Brookline, Mass., Joseph C. Bogue of Watertown, Mass., and Paul H. Hammond of West Medford, Mass. The company is capitalized at $150,000 and proposes to generate and distribute electricity for lamps, heaters and motors.

The Northern Ohio Electric Corporation of New York, N. Y., has filed articles of incorporation with a capital stock of $6,375,000. The company proposes to deal in shares, stocks, bonds, etc., and to promote and finance railroads, gas, steam and hydro-electric light and power plants, systems, etc. The incorporators are: George E. Hardy, John C. Weadock and Jacob Heckma, all of New York, N. Y.

The Central Power Corporation of Vermont has filed articles of incorporation with the Secretary of State with a capital stock of $1,000,000 for the purpose of developing the water powers on the Middlebury River and its branches; also to construct and operate auxiliary steam plants to generate and distribute electricity in Barre and certain towns in Addison, Orange and Washington Counties. The incorporators are: Charles H. Thompson, B. A. Sumner, D. K. Lillie and H. J. M. Jones of Montpelier, Vt.; G. H. Stuart and Albert T. Stuart of Newton, Mass., and Alexander Gordon of Barre, Vt.

The W. L. Battery Company of Poughkeepsie, N. Y., has been incorporated with a capital stock of $100,000. The company manufactures storage batteries, electrical machinery, appliances, etc. The incorporators are: H. B. Vosburgh, J. B. Vandewater and C. V. Lyall, all of Poughkeepsie, N. Y.

H. W. Cotton of New York, N. Y., has filed articles of incorporation with a capital stock of $600,000 for the purpose of doing an electrical, civil and mechanical engineering business; also manufacturers, builders, mill supplies and founders. The incorporators are: W. B. Morrell, H. C. and H. W. Cotton, 233 Broadway, New York, N. Y.

Trade Publications

Portable Tools.—The Stow Manufacturing Company of Binghamton, N. Y., has recently issued a booklet descriptive of its portable tools.

Electric Supplies.—The American Electrical Works of Phillipsdale, R. I., has issued price list dated Nov. 11, 1916, regarding its wires and cables.

Electric Supplies.—The Mohawk Electrical Supply Company of Syracuse, N. Y., has recently issued a folder descriptive of articles for holiday use.

Laboratory Devices.—The Meliorate Manufacturing Company, 240-246 Hall Street, Brooklyn, N. Y., has prepared a leaflet descriptive of its solderless terminals.

Electric Appliances.—The Hotpoint Electric Heating Company of Ontario, Cal., has issued an illustrated folder for Christmas, entitled "Prospects in Your Community."

Lighting Plants.—The Main Electric Manufacturing Company of Pittsburgh, Pa., has recently prepared bulletin No. 60 descriptive of its electric plants for the farm home.

Belts.—"Link-Belt Silent Chain Transmitting Power in the Dye-Making Industry" is the title of bulletin No. 282 now being distributed by the Link-Belt Company of Chicago.

Wiring Devices.—Pass & Seymour, Inc., of Solvay, N. Y., have prepared catalog No. 24 containing illustrations and descriptions of their handy electric wiring devices for 1916 and 1917.

Battery Service.—The K. W. Battery Company of Chicago has issued a booklet entitled "Super-Service—Nothing Less," in which it tells of its battery rental plan, and publishes a facsimile of its order form.

Automobile Batteries.—The Electric Storage Battery Company of Philadelphia, Pa., has issued a bulletin containing the price lists for "Exide" batteries for automobile starting and lighting service.

Transformers.—Catalog No. 160, which is being distributed by the Moloney Electric Company of St. Louis, Mo., contains illustrations which have been taken from photographs of installations of Moloney transformers.

Oil Engines.—The De La Vergne Machine Company, 1200 East 138th Street, New York City, has prepared bulletin No. 160 descriptive of De La Vergne power plants. Views are shown of a few of the power plants recently installed.

Transmission Structures.—"Steel Transmission Structures and Catenary Bridges" is the title of a bulletin brought out by the Archbold-Brady Company, Syracuse, N. Y. This booklet presents views of structures covering a wide range of designs and localities.

Silent Chains.—"Why a Silent High-Speed Chain Drive Is Used on the American Universal Floor Surfacer" is the title of a folder by H. H. Wolfe, mechanical engineer of the American Floor Surfacing Machine Company, Toledo, Ohio.

Supplies and Equipment for Graphic Fact Presentation.—In a 20-page catalog the Educational Exhibition Company, 26 Custom House Street, Providence, R. I., presents descriptions and illustrations of a wide variety of material and equipment for use in the graphic presentation of facts.

Gears.—The Van Dorn & Dutton Company of Cleveland, Ohio, has recently issued a book entitled "Facts About Gears," a reference book for gear buyers. The pages contain essential information needed to design correct gears or to formulate the necessary specifications for ordering gears.

Alloy Steel.—The Vanadium Alloys Steel Company, Pittsburgh, Pa., has for distribution a new pamphlet on "Vasco" vanadium in which is given valuable information as to the study of alloy steels in general and uses for them. This pamphlet also describes the various types of "Vasco" vanadium steel, together with a complete list of carbon steel extras.

Meter Testing Blocks.—Circular No. 29, entitled "Meter Testing Blocks," has recently been distributed by the States Company, 19 New Park Avenue, Hartford, Conn. These blocks are for simplifying the installation, changing and testing of watt-hour meters, which are used in combination with current transformers or with current and potential transformers.

Electrical Apparatus.—Bulletin No. 113, entitled "A Synopsis," has been prepared by the Wagner Electric Manufacturing Company of St. Louis, Mo. This synopsis serves as an index to the subject-matter of Wagner literature and briefly describes the various types of apparatus that have been developed and manufactured by the Wagner Company. This bulletin has been carefully prepared and is well illustrated.

Power Plant Specialties.—"Power Plant Specialties" is the title of a well-prepared and illustrated book and catalog which has been received from the Fisher Governor Company, Marshalltown, Iowa. This catalog is descriptive of governors and regulating devices for pumps; reducing valves and pressure regulating devices; back pressure, automatic exhaust and relief valves, steam traps, diaphragm spring controlled regulators, and other products of this company.

Standard Methods for Testing Molded Insulation.—The Associated Manufacturers of Electrical Supplies, 62 Cedar Street, New York City, has recently prepared Bulletin No. 1, descriptive of standard methods of testing molded insulation as carried out by this association. The bulletin covers standard methods and includes electrical, mechanical, temperature and chemical tests. The electrical test is for dielectric strength or high-potential breakdown. A well-designed high-tension testing transformer, connected to an alternating-current supply, having as nearly a true sine wave as possible is recommended. The transformer and the source of supply of energy must be of ample capacity, not less than 5 kva. The frequency shall not exceed 100 cycles per second. Three mechanical tests are given, the first for tensile strength. A standard testing machine is specified with special clips of hardened steel, hung from links held in the jaws of the machine, so that the pull is central at all times, to avoid any transverse strain. The second mechanical test is that of compressive strength. The same machine is used for testing as for the tensile strength test. The load shall be applied to the test piece by means of any satisfactory pressure head, which will keep the surfaces under pressure parallel at all times. The pressure head used for standard compressive strength test on cement blocks is satisfactory for this purpose. Transverse strength is the third mechanical test. The test piece is supported on two steel blocks, with corners rounded 1.5 m/m (1-16 in.) radius. These supports are 100 m/m (4 in.) apart. The load is applied on top of the test piece by means of a wedge-shaped pressure piece, the edge of which is rounded to a 3 m/m (⅛ in.) radius, extending across the test piece with the edge parallel to the edges of the two supports. The angle of the wedge is approximately 45 deg. and the load is applied at right angles to the test piece, midway between the supports. The test piece is laid flat upon the supports at equal distances from the edges at each end. The temperature test made on this molded insulation is one that distorts under heat. The chemical test is one of absorption of moisture. The apparatus specified is a good chemical balance, a beaker of distilled water at normal room temperature of 21 deg. C. and an oven of any standard make, capable of maintaining a uniform temperature of 100 deg. C. In each case the bulletin specifies the apparatus to be used as mentioned above, outlines the method of making the test, and gives the main points that should be included in the report on the test.

New England

BATH, ME.—The City Council has decided to adopt an ornamental lighting system throughout the business district. The street-lighting service is furnished by the Bath & Brunswick Light & Power Company.

RANGELEY, ME.—The Public Utilities Commission has authorized the Oquossoc Light & Power Company to issue $50,000 in capital stock and bonds of equal amount, the proceeds to be used to purchase the plant and distributing system of the Rangeley Light & Power Company. The Oquossoc company, it is understood, will build a plant and transmission line.

NEW MARKET, N. H.—The Rockingham County Light & Power Company of Portsmouth is erecting a high-tension transmission line into New Market. The company will supply energy in bulk to the New Market Electric Company.

BARRE, VT.—The Central Power Company of Vermont is reported to have acquired an electric generating plant at Granby, P. Q., and proposes to erect a transmission line to Stevens' Mills and to Richford, Vt. Alexander Gordon of Barre is interested in the company.

FALL RIVER, MASS.—The Fall River Electric Light & Power Company is negotiating with the New England Power Company, Osgood-Bradley Building, Worcester, for a connection with the high-tension transmission lines of the company, which now terminate in a substation in Pawtucket, R. I. The local company proposes to erect, operate and own the transmission line from its generating station at the foot of Hathaway Street, Fall River, to the Rhode Island line near Pawtucket, where connection will be made with the lines of the New England Company. A. H. Kimball is general manager of the Fall River Company.

LOWELL, MASS.—The city of Lowell has engaged R. D. Kimball & Company of Boston to prepare plans and estimates of cost for a central power plant for the high school group. The City Council has not yet voted to build the plant.

PITTSFIELD, MASS.—The Pittsfield Electric Company has petitioned for a franchise to erect a transmission line in Lenox.

WEYMOUTH, MASS.—The Weymouth Light & Power Company contemplates extensions to its distributing system.

WORCESTER, MASS.—The Worcester Consolidated Street Railway Company contemplates extending its system to Roachdale.

NEWPORT, R. I.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 26 for construction of three one-story buildings, including heating, plumbing and electric-lighting systems at the naval hospital reservation, Newport, R. I.

DANBURY, CONN.—The installation of an ornamental lighting system in Danbury is under consideration.

NEW LONDON, CONN.—A new power house, new piping shop and new gorge shop are in course of construction at the plant of the New London Ship & Engine Company. The machine shop and foundry are also being enlarged.

Middle Atlantic

BROOKLYN, N. Y.—Bids will be received by the New York Municipal Railway Corporation, 85 Clinton Street, Brooklyn, until Dec. 15, for the erection of third rail, track rail bonding, etc., on the Culver Line. Plans and further information may be obtained at the office of the chief engineer, 85 Clinton Street, Brooklyn.

BROOKLYN, N. Y.—Bids will be received by William Williams, commissioner of gas and electricity, Room 2351, Municipal Building, New York, until Dec. 12 as follows: (1) For furnishing and maintaining electric-lighting units for lighting public streets, parks and places from Jan. 1, 1917, to Dec. 31, 1917, inclusive; (2) for furnishing electric current for light and power in public buildings and for furnishing and maintaining certain equipment during said period; (3) for performing sundry repair and other work to lighting equipment furnished by the city during said period. Further information may be obtained at Room 2324, Municipal Building, New York City.

BUFFALO, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 21, for remodeling of four electric elevators in the United States post office in Buffalo. For details see proposal columns.

FREDONIA, N. Y.—The Village Board is considering equipping the municipal electric-light plant to enable it to supply electricity for lamps and motors to private consumers. At present the plant furnishes municipal service only.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

HUDSON, N. Y.—Preparations are being made by the Albany Southern Railroad Company to extend its electric transmission line from Brainard into the town of New Lebanon, where the company has recently been granted a franchise.

LOCKPORT, N. Y.—The directors of the Board of Commerce have adopted a resolution to recommend to the War Department that the petition of the Erie & Ontario Sanitary Canal Corporation to tap Lake Erie to develop water power be granted. The company proposes to utilize the fall of the water in the canal at the head of the gulf, so called, a ravine west of the city. The drop is 40 ft. and it is estimated that 100,000 hp. could be developed. The canal would cost $30,000,000 and is financed, it is claimed.

NEW YORK, N. Y.—The Ward Baking Company contemplates the construction of a new power house at its plant on Perkins Avenue. C. B. Comstock, 110 West Forty-ninth Street, New York City, is architect.

NEW YORK, N. Y.—Bids will be received by the Public Service Commission, 20 Broadway, New York, until Dec. 14 for the installation of cable feed pipes for part of Seventh Avenue-Lexington Avenue Rapid Transit Railroad. James B. Walker is secretary of commission.

NEW YORK, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 27 for the installation of two electric passenger elevators, etc., in the United States appraisers' warehouse, New York City. For details see proposal columns.

NEW YORK, N. Y.—Bids will be received by Robert Adamson, fire commissioner, eleventh floor, Municipal Building, New York City, until Dec. 12 for furnishing 40 miles of triple-braided, weatherproof, hard-drawn copper wire, No. 10 B. & S. gage. Blank forms and further information may be obtained at the above office.

NEW YORK, N. Y.—Bids will be received by A. Woods, police commissioner, at the bookkeeper's office, headquarters of the Police Department, 240 Centre Street, New York City, until Dec. 11, for furnishing and installing an electric lighting wiring system and fixtures at the 17th, 22d and 43d precinct station houses in the borough of Manhattan. Blank forms and further information may be obtained at the above office.

NEW YORK, N. Y.—Bids will be received by the Department of Public Charities, Tenth Floor, Municipal Building, New York City, until Dec. 15 for furnishing material and constructing 21 pavilion buildings, a group building and a dining hall at Sea View Hospital, borough of Richmond, as follows: (1) For general construction; (2) plumbing; (3) heating; (4) electric work. Blank forms and further information may be obtained at the office of Renwick, Aspinwall and Tucker, architects, 8 West Fortieth Street, New York, where plans and specifications may be seen.

NEW YORK, N. Y.—Bids will be received by William Williams, commissioner of water supply, gas and electricity, Room 2318, Municipal Building, New York City, until Dec. 12 for furnishing and maintaining electric-lighting units as follows: (1) For lighting public streets, parks and places from Jan. 1, 1917, to Dec. 31, 1917, inclusive; (2) for furnishing electric current for light and power in public buildings and for furnishing and maintaining certain equipment during said period; (3) for performing sundry repair and other work to lighting equipment furnished by the city during said period in the boroughs of the Bronx and Queens. Blank forms and further information may be obtained at Room 2324, Municipal Building.

NEW YORK, N. Y.—Bids will be received by the board of trustees, Bellevue and Allied Hospitals, in the office of the general medical superintendent, Bellevue Hospital (entrance 415 East Twenty-sixth Street), New York City, until Dec. 12, for furnishing material and labor to construct destructor building extension and to connect destructor to power house at Harlem Hospital, situated at 136th Street and Lenox Avenue, borough of Manhattan. Bids will also be received at the same time and place for furnishing and installing a recording feed water meter with register indicator instrument on the main boiler feed line in the power house at Bellevue Hospital. Further information may be obtained at the office of the chief clerk, 400 East Twenty-ninth Street, New York City.

ROCKVILLE CENTRE, N. Y.—At an election held Dec. 1 the taxpayers voted to appropriate $18,000 for the installation of a new electric generator in the municipal electric-light plant.

SPENCER, N. Y.—Bids will be received by C. J. Keefe, city clerk, Spencer, until Dec. 18 for the installation of an electric-light plant of approximately 375 kva. capacity. The equipment will include boiler, feed water heater, stokers, coal-handling apparatus, cooling tower, turbo-alternator, condenser, steam engine, oil engine, oil storage tanks and piping, electric generator, switchboard, etc. W. E. Skinner, Plymouth Building, Minneapolis, Minn., is consulting engineer. For details see proposal columns.

WETMORE, N. Y.—The property of the Wetmore Electric Company of Lowville has been purchased by the Northern New York Utilities, Inc. Energy to operate the local system, it is understood, will be supplied by the high-tension transmission lines of the Northern New York Utilities Company.

AMBRIDGE, PA.—The Duquesne Light Company of Pittsburgh has purchased a site in Ambridge on which it will erect a substation, which will supply energy for the Beaver Valley Traction Company.

JONESTOWN, PA.—Governor Brumbaugh has approved the charters of the Union Township and the Bethel Township Companies of Jonestown. Each company is capitalized at $5,000. L. B. Myers of Philadelphia is treasurer of both companies.

PEN ARGYL, PA.—The construction of a new electric railway between Wind Gap and Stroudsburg, 15 miles long, during 1917, is under consideration by the Slate Belt Street Railway Company of Pen Argyl.

PITTSBURGH, PA.—Bids will be received at the United States Engineer Office, Pittsburgh, until Dec. 29 for furnishing and delivering two air compressors and one water turbine at Lock No. 3, Monongahela River.

POTTSVILLE, PA.—Plans are being considered for the installation of an ornamental lighting system on Centre Street.

BORDENTOWN, N. J.—The City Commission is considering the installation of an electric fire-alarm system.

SOUTH ORANGE, N. J.—Bids will be received by the Township Committee of South Orange until Dec. 19 for the installation of a police-alarm telegraph system. F. O. Runyon is chairman.

WILMINGTON, DEL.—Steps have been taken by the Ninth Street Association to secure a better lighting system on Ninth Street.

BALTIMORE, MD.—Eustis H. Thompson, Munsey Building, Baltimore, would like to receive estimates on 250-volt rotary converters, 500 to 1000 kw., with transformers, 25 and 60 cycles, 13,000 volts; also motor generator set of same rating, or large direct-current generators.

BALTIMORE, MD.—The Consolidated Gas, Electric Light & Power Company has been granted a permit to lay two heavy cables under the river from the foot of Clinton Street to the old quarantine grounds in Anne Arundel County to supply the industries at Curtis Bay with energy.

BALTIMORE, MD.—The Baltimore Enamel & Novelty Company, Woodall and Clements streets, Baltimore, contemplates the erection of a factory., 262 ft. by 458 ft., two stories high, to cost about $125,000. Equipment will include enameling furnaces, power plant, heating apparatus, elevators, electric wiring, industrial railway tracks, etc. G. E. Painter, 324 North Charles Street, Baltimore, is engineer.

CUMBERLAND, MD.—The Cumberland & Westernport Electric Railway Company, it is reported, has two new power plants under construction.

INDIAN HEAD, MD.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 26 for furnishing and installing a motor-driven centrifugal pump and all piping, fittings, valves, hydrants and accessories necessary for an extension to the high-pressure fire system at the naval proving ground, Indian Head.

CLARKSBURG, W. VA.—An agreement has been entered into between the Monongahela Valley Traction Company of Fairmont and the Clarksburg Light & Heat Company by which a large transformer station will be erected in Clarksburg to enable the companies to supply energy to one another in case of emergency.

FAIRMONT, W. VA.—The Monongahela Valley Traction Company contemplates the

erection of a high-tension transmission line from its power house to Pleasant Valley, where industrial plants are to be established.

MARTINSBURG, W. VA.—The Potomac Light & Power Company, which took over the property of the Martinsburg Power Company, contemplates improvements to the system, including the reconstruction of dams Nos. 4 and 5 on the Potomac River.

ABINGTON, VA.—The Abington Utilities Company, recently organized to take over the electric plant of the Abington Water & Light Company, will make improvements to the plant and system. As yet definite plans have not been decided upon. The new company is capitalized at $100,000.

NORFOLK, VA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 18 for two electric freight elevators, one each for the new structural shops at the navy yard at Norfolk, Va., and Philadelphia, Pa.

RICHMOND, VA.—Permit has been granted to the Virginia Railway & Power Company to erect a 13,500-volt transmission line to connect with the American Locomotive Works to supply energy for power purposes.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 26 for furnishing and installing one 80-ton bridge crane, three 15-ton bridge cranes, twelve 5-ton wall cranes and eight 3-ton wall cranes, more or less, in each of the new structural shops (all to be electrically driven), at the navy yards, Norfolk, Va., and Philadelphia, Pa. All motors used to be 220 volts, direct-current.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Washington, D. C., Schedule 462—furnishing and installing pneumatic tube system; Schedule 467—one motor delivery wagon. Philadelphia, Pa., Schedule 479—20,000 lb. evaporator tubes. Brooklyn, N. Y., Schedule 475—360 push buttons, miscellaneous interior communication cable, 1200 wall receptacles, 16,000 terminals for connection boxes, miscellaneous magnet wire, miscellaneous single and double conductor wire, miscellaneous twin conductor wire; Schedule 474—115,000 ft. ships' lighting cable, 10,000 ft. lighting and power wire, 90,000 ft. telephone wire; Schedule 480—miscellaneous sheet copper. Applications for proposal blanks should designate the schedule desired by number.

North Central

DETROIT, MICH.—The General Motors Company contemplate the construction of a large new plant on Scotten Avenue and Holbrook Street, to cost several million dollars. The plans provide for a large power plant. When completed it will house the entire manufacturing department of the Cadillac Motor Car Company.

MARQUETTE, MICH.—The Piqua Handle Company of Marquette, it is reported, will soon award contracts through J. J. Wenette, engineer, Grand Rapids, for a group of eight buildings, including a power house. The power plant will have a capacity of about 1000 hp.

ATHENS, OHIO.—Application has been made to the State Board of Administration for appropriation for a power plant (to cost about $50,000) and other improvements at the Ohio State Hospital at Athens.

CINCINNATI, OHIO.—Equipping the mill of the A. M. Lewis Lumber Company for electrical operation in the near future is under consideration. A 300-hp. generating plant is to be installed to furnish energy to operate the machinery.

CINCINNATI, OHIO.—Orders have been placed by Eli M. West, receiver for the Columbus, Delaware & Marion Railway Company for new equipment for the Marion and Stratford power plants and the Prospect substation, to cost about $27,000. Contracts have been placed for copper wire and transformers, amounting to about $6,000, for the local lighting system. The equipment for the Marion power plant will consist of a 750-kva. frequency changer set, one 50-kw. motor-driven exciter set, three switchboard panels and one voltage regulator; three 220-kw. transformers, which the company has in stock, will also be installed. At the Stratford plant one 425-hp. Heine boiler and smokestack, and one 3000-gal.-per-minute turbine-driven centrifugal circulating pump will be installed. Three 100-kw. transformers will be placed in the Prospect substation.

CLEVELAND, OHIO.—A new proposal has been submitted to the Cleveland Railway Company for furnishing energy from the municipal electric plant to operate its cars. If the contract is secured W. E. Davis, lighting commissioner, will recommend the purchase of two 15,000-kw. generators for the East Fifty-fifth Street station. In case the contract is not obtained a recommendation for the purchase of one generator will be made.

DAYTON, OHIO.—The Dayton Power & Light Company is erecting a transmission from Cedarville to South Charleston; another to Englewood and Union and also one to Vandalia.

DOVER, OHIO.—The contract for addition to the municipal electric-light plant has not been awarded owing to bids being above the estimates. Order for the additional generating unit for the plant will not be placed before next summer. The contract signed by the Bruce-Macbeth Engine Company of Cleveland, which is to furnish both generator and gas engine and all other equipment needed, calls for delivery by May 1, 1917.

MASSILLON, OHIO.—The substation, transformers and car barns of the Northern Ohio Traction Company of Akron at Massillon were recently destroyed by fire, causing a loss of about $50,000.

MILFORD, OHIO.—The Cincinnati, Milford & Loveland Traction Company, it is reported, contemplates reconstructing the lighting system in Milford. The company is negotiating with the Village Council for a renewal of the street-lighting contract, which expires next April.

NEWARK, OHIO.—The Ohio Electric Railway Company of Cincinnati contemplates extending its North Fourth Street car line in Newark to take in the northwestern part of the city.

PIQUA, OHIO.—Negotiations are under way between the City Council and the Dayton Power & Light Company for the installation of an ornamental lighting system.

TOLEDO, OHIO.—The Cincinnati, Hamilton & Dayton Railroad Company and the Baltimore Railroad Company are planning to build a refrigerating plant in Toledo, to cost approximately $250,000. The plant will be used jointly by both companies to serve in the handling of food products for use in this city and surrounding territory.

WASHINGTON C. H., OHIO.—Plans are being considered by the Washington Gas & Electric Company for extensions and improvements to the street-lighting system, which will probably include the installation of an ornamental lighting system.

GLASGOW, KY.—The City Council has approved a 20-year franchise granted to the Kentucky Utilities Company of Lexington, which has taken over the plant and holdings of the Glasgow Electric Light & Ice Company. The Kentucky company, it is said, will establish a central station in Glasgow to supply electricity to towns and cities in this vicinity.

HILLSIDE, KY.—The tipple, engine room and boiler house of the Advance Coal Company of Hillside were recently destroyed by fire, causing a loss of about $30,000. W. S. Thomson of Madisonville is superintendent.

WINCHESTER, KY.—Plans are being prepared by Edgar B. Kay, engineer, Colonial Building, Winchester, for construction of a hydroelectric plant at Lock 10, Kentucky River, to develop 2000 hp. Plans are also being prepared for waterworks system, to cost about $180,000, which will include construction of power house, pumping station, installation of two 1,500,000-gal. pumps, three low-duty pumps, 500 hp. boiler capacity, etc.

ANDERSON, IND.—The contract for the new 5000-kw. turbo-generator unit for the municipal electric-light plant has been awarded to the Hatfield Electric Company of Indianapolis at $96,895. Contract for enlarging the power house will soon be awarded.

EDWARDSPORT, IND.—Plans have been announced by the Indiana Power & Water Company of Bloomfield, which has taken over the plant of the Bicknell (Ind.) Light & Power Company and the property of the Linn Coal Company, to erect a large electric generating plant in Edwardsport to furnish electricity for two of the mines in Bicknell, the city of Bicknell, Edwardsport and Elnora. Later the Bicknell plant will be enlarged to supply energy in that city and the new plant will furnish electrical service to towns between Edwardsport and Elnora. The Utilities Development Corporation of Chicago has charge of the construction and development work.

ELKHART, IND.—The Indiana-Michigan Electric Company of South Bend has petitioned the County Commissioners for a franchise to erect electric transmission lines from Elkhart to the west corporation line of Bristol and from the east corporation line of Bristol along the Mottville to the state line.

CHESTER, ILL.—The property of the Chester Light & Ice Company has been purchased by the Saline Electric Company of Hillsboro. The Saline company has also bought the water-works system of the Chester Water & Power Company.

CHICAGO, ILL.—Plans are being prepared by R. G. Pierce, 7136 Yates Avenue, Chicago, for the erection of a four-story factory and power house (one story), at Belmont and Kilbourn Avenues, to cost about $85,000.

CHICAGO, ILL.—Bids will be received by the South Park Commissioners, Fifty-seventh Street and Cottage Grove Avenue, Chicago, Ill., until Dec. 20 for furnishing and delivering at the South Park store yard 300 electric lamp globes, 18 in. by 7 in.

CHICAGO, ILL.—The Clemetson Company, 2607 Flournoy Street, Chicago, is planning to erect a factory at West Division Street and Homan Avenue, consisting of a main building, 75 ft. by 276 ft., three stories, a kiln, 30 ft. by 35 ft., and a power house, 40 ft. by 65 ft., of reinforced concrete. Webster Tomlinson, 64 East Van Buren Street, is architect.

COALTON, ILL.—The Public Utilities Commission has granted the Central Illinois Public Service Company of Mattoon permission to erect a transmission line to Coalton to supply electrical service here.

GRANITE CITY, ILL.—The Public Utilities Commission has granted the Madison County Light & Power Company of Granite City permission to erect a transmission line from Granite City to Nameoki to supply electrical service there. The company has filed an application with the Public Utilities Commission asking for a certificate of convenience and necessity to erect a transmission line from Wood River to the village of Hartford.

HIGHWOOD, ILL.—The Chicago, North Shore & Milwaukee Electric Railway Company contemplates extending its Libertyville and Area branch to tap the lake districts of the county. The railway may eventually be extended to Woodstock and McHenry. W. D. Johnson, 209 South La Salle Street, Chicago, is receiver.

SPARTA, ILL.—The plant and holdings of the Sparta Gas & Electric Company have been purchased by the Saline Electric Company of Hillsboro.

SPRINGFIELD, ILL.—At the election held Nov. 7 the proposal to purchase an auxiliary generator for the municipal electric-light plant was approved by the voters.

MILLTOWN, WIS.—The town of Milltown has granted A. O. Dahlberg of Clam Falls a franchise to install and operate an electric-lighting system for a period of 25 years. Electricity will probably be secured from Balsam Lake.

SHEBOYGAN, WIS.—Plans are being prepared by the Sheboygan Dairy Products Company for the construction of a one-story power house and dairy building.

SHEBOYGAN, WIS.—The Phoenix Chair Company is considering some changes in its power plant, which include the installation of a 200-hp. Corliss engine, a 500-kva., three-phase, 60-cycle generator directly connected to a Corliss engine.

STANLEY, WIS.—The local electric-light plant, owned by the North Western Lumber Company, has been purchased by the Wisconsin-Minnesota Light & Power Company of Eau Claire. The high-tension transmission line of the light and power company, which runs from Chippewa Falls to Boyd, it is understood, will be extended to Stanley.

THORP, WIS.—The Wisconsin-Minnesota Light & Power Company of Eau Claire, it is reported, is negotiating for the purchase of the municipal electric-light plant. The company contemplates extending its transmission lines to this city.

EVELETH, MINN.—The city of Eveleth is contemplating the installation of two electrically-driven pumps of 1,000,000 gal. capacity.

ST. PAUL, MINN.—The Northern States Power Company of St. Paul has secured a contract with the Northern Dredging & Dock Company covering 1265 hp. in motors. This installation will be used by the Dredging & Dock Company for dredging the river channel and filling in site to be occupied by the new Armour packing plant at South St. Paul.

BLOOMFIELD, IOWA.—Plans are being considered for improvements to the municipal electric-light plant, involving an expenditure of about $25,000 next spring.

DELHI IOWA.—The Board of Railroad Commissioners has granted the Iowa Electric Company of Marengo permission to erect an electric transmission line from Delhi to Oneida and Worthington to supply electrical service in those towns.

ELMA, IOWA.—The Consumers Electric Company of Elma has recently completed a

transmission line from Elma to Riceville. The company has closed a contract for street-lighting in Riceville, under the terms of which it will furnish a minimum of 35 lamps.

MASON CITY, IOWA.—Bids will be received by the board of directors of the independent school district of Mason City, until Dec. 18 for construction of an eight-grade school building, including heating, plumbing, electric wiring, etc, etc. E. R. Bogardus of Mason City is architect.

NEW HAMPTON, IOWA.—Improvements involving an expenditure of about $10,000 are contemplated to the municipal electric-light plant. Orders, it is reported, have been placed for one 250-kva. turbine, one 125-kva. and a seven-panel switchboard.

NORA SPRINGS, IOWA.—The Nora Springs Light & Power Company is contemplating improvements to its plant.

WEBSTER, IOWA.—Bids, it is reported, will be received about Jan. 8 for improvements to the municipal water and electric-light plant, including the installation of a 500-kw. steam turbine, boiler, etc., to cost about $18,000. H. G. Vollmer is city manager.

LESTERVILLE, S. D.—The City Council is considering an election to submit the proposal to issue $18,000 in bonds for the installation of a municipal electric-light plant to the voters.

OAK, NEB.—The Meyer Hydro-Electric Power Company of Oak has recently signed a contract to furnish electricity for lamps and motors to the village of Oak. Negotiations are under way between the company and several other towns to supply electrical service, which may result in a number of extensions to the transmission lines of the company next season. Ernst Meyer is president.

MORAN, KAN.—Bids will be received by the city of Moran until Dec. 18 for the construction of an electric-light plant and waterworks system. The cost of the electric plant is estimated at $12,000 and the waterworks $30,000. W. B. Rollins & Company, Railway Exchange Building, Kansas City, Mo., are engineers.

MULLINVILLE, KAN.—Bids will be received by the city clerk of Mullinville until Dec. 15 for the purchase of $10,000 bond issue, recently authorized for the erection of a transmission line and distribution system.

SCOTT CITY, KAN.—The Garden City (Kan.) Sugar Beet Company is negotiating with the City Council to furnish electricity to Scott City.

Southern States

MADISON, N. C.—The Town Council has voted to grant a franchise for the installation of an electric-light plant in Madison.

COLUMBIA, S. C.—Surveys are being made by the Columbia Railway & Navigation Company for the construction of a railway (probably operated by electricity) from Columbia to Greenwood, a distance of about 70 miles. G. A. Guignard of Columbia is president.

JACKSONVILLE, FLA.—Plans are being prepared by Mellen C. Greely of Jacksonville for the Stanton School for negroes, to cost about $90,000, which will be equipped with steam heat, electric light and power; also shops to be operated by electricity.

STUART, FLA.—A franchise has been granted the Southern Utilities Company, Heard National Bank Building, Jacksonville, to construct and operate electric-lighting system and waterworks in Stuart.

MANCHESTER, TENN.—A committee has been appointed by the City Council to negotiate with the Public Service Company for improvements to the street-lighting system in Manchester.

MEMPHIS, TENN.—The Memphis & Rugby Railroad Company of Memphis, which is building a railway between Memphis and Rugby, it is reported, is purchasing machinery for a power plant at Rugby Park.

BEAVER, OKLA.—At an election to be held Dec. 11 the proposal to issue $8,000 for the installation of an electric-light plant and $17,000 for water-works system will be submitted to the voters.

COLLINSVILLE, OKLA.—Plans are being considered by the City Commissioners for extensions to the municipal electric-light plant.

TULSA, OKLA.—The Sand Springs Railway Company is planning to build an extension of its railway from Sand Springs to Pawhuska, a distance of about 50 miles.

BEAUMONT, TEX.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 28 for miscellaneous repairs to heating and plumbing systems in the United States post office and court house, Beaumont. For details see proposal columns.

MARLIN, TEX.—The Marlin Ice & Electric Company is contemplating extensions and improvements to its electric plant.

NEWCASTLE, TEX.—The Newcastle Light & Power Company has been granted a franchise to install and operate an electric light plant here.

ROGERS, TEX.—Electrical equipment for operating the local water-works system will be installed by the Texas Power & Light Company of Dallas, which will extend its transmission lines to Rogers soon.

SAN ANGELO, TEX.—The franchise recently granted by the City Council to the Interstate Electric Corporation of New York for operating a street railway system in San Angelo has been confirmed by the voters. The company, it is stated, will make improvements to the electric plant and extensions to the street railway system, at a cost of about $125,000.

TERRELL, TEX.—At the referendum election held recently the proposal to sell the municipal electric light plant to the Texas Power & Light Company of Dallas was defeated

VALLEY VIEW, TEX.—Plans are being considered by Mr. Jones, manager of the motion picture theater, for the installation of an electric plant for the theater and his other establishments.

WINTERS, TEX.—The Winters Light & Milling Company has filed amendment to its charter, changing its name to the Winters Light & Power Company. The company, it is understood, contemplates improvements to its system.

Pacific States

CASHMERE, WASH.—Plans are being considered by the Town Council for the installation of a municipal electric-light plant to supply electricity for the town of Cashmere and surrounding country. A movement is under way to have the towns of Dryden, Peshastin and Leavenworth combine in the project, thereby covering the entire valley from Cashmere to Leavenworth. It is stated that a power site on the Icicle River could be developed to furnish all the power needed.

SPOKANE, WASH.—The Washington Water Power Company of Spokane has applied for a franchise to erect a new electric transmission line on certain roads in Lincoln County.

TACOMA, WASH.—The Pacific Telephone & Telegraph Company will soon begin work on extending its service south of Forty-eighth Street and west of Sheridan Street, at a cost of about $25,000. The work includes 20,000 ft. of aerial cable and miscellaneous underground construction.

GRANTS PASS, ORE.—The contract for electrical work for the new Josephine County court house at Grants Pass has been awarded to Miller & Halls of Portland.

HILLSBORO, ORE.—The North Coast Power Company of Portland will begin work at once on the erection of a substation on Second Street.

MARSHFIELD, ORE.—H. M. Byllesby & Company of Chicago, Ill., which controls the Oregon Power Company, have approved the expenditure for the construction of an 11,000-volt transmission line from Marshfield to Coquille for the purpose of furnishing electricity to the Coquille River Valley towns from the power plant operated in connection with the Smith sawmill at Marshfield. The line between Coquille and Myrtle Point is being repaired.

EUREKA, CAL.—Plans are being considered by the Western States Gas & Electric Company for the installation of new street-lighting system in the business district. It is proposed to install 54 lamps, to cost about $8,000.

HALF MOON BAY, CAL.—The Railroad Commission has authorized the Halfmoon Bay Light & Power Company to sell its property to the Great Western Power Company for $47,500. The system consists of an 11,000-volt transmission line, 24 miles long, extending from Daly City to 1 mile south of Half Moon Bay, together with 12 miles of distribution lines, transformers, etc.

HANFORD, CAL.—The Hanford Gas & Electric Company has petitioned the Railroad Commission for permission to issue $70,000 in bonds, the proceeds to be used to pay off present indebtedness of $40,000 and the remainder to be used for extensions and betterments.

HANFORD, CAL.—The controlling interest of the H. G. Lacey Company, which supplies electricity in Hanford, has been sold to the Huntington Land & Improvement Company, a subsidiary of the Pacific Electric Company of Los Angeles. The H. G. Lacey Company has filed an application with the Supervisors of Kings County asking for a blanket franchise covering Kings County to enable the company to make further extensions.

MERCED, CAL.—Plans have been approved by the City Trustees and bids will soon be asked for the installation of an ornamental lighting system in Merced, to cost about $10,000.

NILAND, CAL.—The Southern Sierras Power Company of Riverside contemplates erecting an electric transmission line from Niland to the head of Alamo Canal near the Mexican border to supply energy to the Imperial Irrigation District, to cost about $150,000.

SAN FANCISCO, CAL.—The Municipal Railways of San Francisco, it is reported, contemplates the construction of about 20 miles of new tracks into residence districts not touched by the city lines.

BOISE IDAHO.—The Gem Irrigation Company of Owyhee County has petitioned the State Land Board to authorize a contract between the State of Idaho and the irrigation district for the construction of a $300,000 power plant at the Arrow Rock dam for furnishing the Gem District with electricity for pumping purposes. The contract would have to be passed by the State Legislature. The proposal, it is said, has the approval of Governor M. Alexander, and also the members of the State Land Board.

HAILEY, IDAHO.—Plans have been approved and funds appropriated by the Mascot Mining & Milling Company for the construction of a mill and power plant.

TERRY, MONT.—The Terry Development, recently incorporated, has purchased the property of the Terry Light & Power Company. The present plant is considered too small to meet the demands of the town. The new company proposes to install an auxiliary steam plant, to double the output of the plant as soon as possible. Application has been made to the Town Council for a contract for lighting the streets and public buildings. The cost of the improvements is estimated at $20,000.

PUEBLO, COL.—Early next year the Arkansas Valley Railway, Light & Power Company of Pueblo will erect about 10 miles of 13,000-volt transmission line to serve several large irrigating projects in the Arkansas Valley.

Canada

TRAIL, B. C.—Extensive improvements are contemplated to the municipal electric-light plant, involving an expenditure of about $25,000.

WINNIPEG, MAN.—The greater Winnipeg water district, it is reported, contemplates the construction of an electric railway from Provencher Bridge to Transcona, via St. Boniface, Notre Dame and the Mission Road. W. G. Chace is chief engineer.

GRIMSBY, ONT.—The Radiest Electric Company contemplates extensions to its plant, to cost about $20,000.

HEPWORTH, ONT.—The installation of an electric-light plant in Hepworth is under consideration by the Town Council.

KILSYTH, ONT.—The Ontario Hydro-Electric Power Commission contemplates the construction of a substation in Kilsyth and to erect transmission lines from Tara.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Dec. 20 for steel reinforcing bars, wrought iron or steel pipe, steel cable, galvanized wire, chain, bronze, brass tubing, compression cups, valves, cable thimbles, cable clips, etc. Blanks and general information relating to this circular (No. 1105) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Dec. 27, for furnishing galvanized steel, spring steel, electric cable and wire, steel conduit and fittings, electric fittings, electric meters, electric fans, reflectors, slate slabs, insulating tape, spark plugs, fire extinguishers, tally registers, etc. Blanks and general information relating to this circular (No. 1106) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York City; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

Installation and Management of High-Tension Equip-

14,219. Centrifugally-Regulated Power-Transmission System; William Morrison, Chicago, Ill. App. filed Sept. 9, 1916. Involving the use of dynamo-electric clutches.

1,205,971. Electric Insulator; Claudio Buschetti, Milan, Italy. App. filed April 10, 1915. New and useful improvements.

1,206,011. Alarm for Boxes and Other Receptacles; Charles A. Mahla, Jersey City, N. J. App. filed Nov. 27, 1914. Device for giving an alarm when a box or other form of receptacle is moved.

1,206,021. Wire Clamp and Hanger; Otto Mueller, Chicago, Ill. App. filed July 16, 1915. For holding and supporting wires, such as trolley wires.

1,206,053. Telephonic Fire-Alarm Apparatus; Everett L. Thompson, Dover, N. J. App. filed April 27, 1916. For automatically transmitting fire-alarm signals over regular telephone circuits.

1,206,057. Electric-Arc Furnace; Clas Walther Harry von Eckermann, Ljusne, and Ivar Rennerfelt, of Djursholm, Sweden. App. filed July 15, 1915. Horizontally elongated crucible provided with a plurality of systems of electrodes.

1,206,061. Current Rectifier; William F. Warner, Davenport, Iowa. App. filed Jan. 20, 1916. Electrolytic type.

1,206,084. Shade-Supporting Lamp Socket; Reuben B. Benjamin, Chicago, Ill. App. filed March 1, 1912. Pendant socket.

1,206,085. Conductor Grip; Reuben B. Benjamin, Chicago, Ill. App. filed April 19, 1912. In connection with pendant electrical devices.

1,206,093. Electric Pad-Heating Device; Ralph W. Chapman, Oldtown, Me. App. filed Dec. 24, 1915. Quickly and efficiently heating moist pads by electricity.

1,206,095. Flash-Light Mace; Joseph A. Coy, Ludlow, Ky. App. filed June 23, 1915. Or other weapon.

1,206,122. Electroplating Machine; Edward J. Miller, Jennings, Mo. App. filed June 16, 1916. The work is automatically and positively turned.

1,206,136. Switch; John Allen Parsons, Philadelphia, Pa. App. filed April 26, 1915. Inclosed fuse switch which cannot be opened until the electric circuit is broken.

1,206,145. Trolley; Richard Schrader, Utica, N. Y. App. filed Feb. 19, 1916. For automatically restoring the trolley wheel.

1,206,157. Overload Protective Device; Halfdan A. Steen, Milwaukee, Wis. App. filed July 22, 1911. Provide an electrical adjustment.

1,206,158. Safety Strain Insulator; Louis Steinberger, Brooklyn, N. Y. App. filed July 25, 1912. For the insulation of wires carrying currents of high voltage.

1,206,159. Safety Strain Disk Insulator; Louis Steinberger, Brooklyn, N. Y. App. filed July 25, 1912. For high voltages.

1,206,160. High-Potential Insulator; Louis Steinberger, Brooklyn, N. Y. App. filed Aug. 21, 1912. Pin type.

1,206,207. Incubator Alarm; Alvia R. Cox, Ada, Okla. App. filed Sept. 24, 1915. To give an alarm signal when the temperature of the incubator rises and lowers to an abnormal or dangerous degree.

1,206,244. Electric Switch; Joseph Leveque-Petit, Brussels, Belgium. App. filed April 24, 1912. The switch blade is retained by an abutment during the tensioning of the spring.

1,206,245. Extension Plug for Electric Lights, Etc.; Arthur L. Powell, Colorado Springs, Col. App. filed Nov. 17, 1915. New and useful improvements.

1,206,254. Subsidiary Plant for Driving Propeller Shafts When Not Under Load; Martin Roelling, Bremen, Germany. App. filed Aug. 23, 1912. The whole power for propelling the ship is directly transmitted from the engine to the propeller without undergoing any transformation.

1,206,259. Splicer for Trolley-Conductors; William Schaake, Pittsburgh, Pa. App. filed Aug. 7, 1911. Greater strength and more effective and durable in service.

1,206,260. Electrical Transformer; Alf Schaanning, Manchester, and George Harlow, Altrincham, England. App. filed Sept. 1, 1916. Relates to castings or tanks.

1,206,274. Portable Electric Light; Charles Wachtel, Brooklyn, N. Y. App. filed May 21, 1914. New and useful improvements.

1,206,284. Maximum-Demand Meter; Claxton E. Allen, Pittsburgh, Pa., and Edward M. Fay, Wilkinsburg, Pa. App. filed March 28, 1913. New and useful improvement.

Record of Electrical Patents

Notes on United States Patents issued on Nov. 25, 1916.

1,206,285. Portable Electric Light; Charles Wachtel, Brooklyn, N. Y. App. filed Dec. 9, 1914. Novel and efficient circuit closer.

1,206,293. Electrical Measuring Instrument; Clarence A. Boddie, Pittsburgh, Pa. App. filed June 5, 1913. Indicate the true maximum reading by means of a pointer on a circular scale.

1,206,294. Maximum-Demand Meter; Clarence A. Boddie, Pittsburgh, Pa. App. filed Oct. 2, 1914. For indicating the time of the occurrence of a maximum demand.

1,206,295. Electrical Measuring Instrument; Clarence A. Boddie, Pittsburgh, Pa. App. filed Oct. 7, 1915. Maximum-demand wattmeters.

1,206,296. Alarm Device; Addison E. Boggs, Pittsburgh, Pa. App. filed Feb. 3, 1915. Indicate by either an audible or a visible signal.

1,206,298. Thermostat; John H. Bruhn, Spirit Lake, Iowa. App. filed June 30, 1914. Employing a bar consisting of two differentially expansible materials fixed together as a thermostatic element.

1,206,301. Electric Flat-Iron; Edward A. Carson, Compton, Cal., and Joseph Atherton, Redondo, Cal. App. filed April 26, 1916. Indicating device.

1,206,304. Electrical Measuring Instrument; Lewis W. Chubb, Edgewood Park, Pa. App. filed Jan. 2, 1915. Provide a thermo-electric potentiometer.

1,206,308. Overhead Structure for Trolley-Conductor; Charles H. Davis Pittsburgh, Pa. App. filed May 7, 1913. Steadying of trolley conductors of high-speed electric railways.

1,206,314. Electric Locomotive; George M. Eaton, Wilkinsburg, Pa. App. filed Jan. 7, 1911. Provide a simple and durable journal box or bearing structure for electric locomotives.

1,206,333. Electric Lamp; Frederick G. Keyes, East Orange, N. J. App. filed March 6, 1914. Crimped ribbon filament.

1,206,347. Circuit Interrupter; Howard G. MacDonald, Wilkinsburg, Pa. App. filed Feb. 15, 1912. Oil-immersed type which are provided with means for both manual and automatic release.

1,206,356. Fireman's Helmet; Charles H. Norton, New York, N. Y. App. filed March 20, 1916. The wearer of the helmet may signal to others at a distance.

1,206,357. Means for Preventing the Generation of Static Electricity in Moving-Picture Apparatus; George W. Nusbaum, Takoma Park, Md. App. filed Aug. 7, 1914. By a movable dielectric member.

1,206,376. Binding Post; Karl C. Randall, Edgewood Park, Pa. App. filed Feb. 3, 1915. For fusible conductors.

1,206,382. Trolley Finder or Catcher; Harry B. Sawyer, Ogden, Utah. App. filed Dec. 11, 1915. A harp for engagement with a trolley pole.

1,206,388. Elevator System; August Sundh, Hastings-on-Hudson, N. Y., and Waldemar F. Mayer, Hoboken, N. J. App. filed May 7, 1914. Employing as a motive power a prime mover.

1,206,392. Electric Water Heater; Jesse F. Wheelock, Dobbins, Cal. App. filed July 14, 1914. Adapted to be immersed in the liquid to be heated.

1,206,393. Meter Test Block; Roger S. White, Washington, D. C. App. filed April 10, 1914. Enable the operator to quickly and safely make the necessary connections without disturbing the meter wires.

1,206,394. Meter Test Block; Roger S. White, Washington, D. C. App. filed May 8, 1915. Where comparatively large quantities of current are carried.

1,206,396. Multiple Pothead; Paul F. Williams, Chicago, Ill. App. filed June 1, 1908. Adapted for a plurality of conductors.

1,206,431. Electric Wiring Fixture; Bird Malvin Graybill, Chicago, Ill. App. filed May 26, 1915. For supporting and positioning outlet boxes.

1,206,454. Push-Button Circuit Controller; Ray H. Manson, Elyria, Ohio. App. filed Aug. 18, 1914. Large unprotected operating area.

1,206,477. Electric Lamp; William H. Spencer, New York, and James T. Holmes, Brooklyn, N. Y. App. filed Dec. 30, 1915. For indirect lighting.

1,206,510. Electrical Heating Unit; Caryl E. Chaney, Detroit, Mich. App. filed June 19, 1916. Armored resister type.

1,206,524. Phantom Loading Coil; William Fondiller, New York, N. Y. App. filed Dec. 2, 1915. To simultaneously load two physical circuits and the derived phantom circuit while maintaining a high degree of balance.

1,206,531. Automatic Fire Alarm; Daniel P. Gosline, Boston, Mass. App. filed June 13, 1914. Transmit automatically the news of fire to a central station.

1,206,549. Outlet Box; Allan R. Lakin, New York, N. Y. App. filed Jan 14, 1914. Improved means for effecting an adjustment of the outer exposed plates.

1,206,552. Electric Switch; Bennett M. Leece, Cleveland, Ohio. App. filed June 10, 1915. For lighting, or starting and lighting apparatus.

1,206,561. Lighting-Fixture; Wilfrid Lumley, Conneaut, Ohio. App. filed Sept. 26, 1913. Mounting of electric lamps of large candle power in such a manner that the portion of the fixture which receives the base of the lamp is ventilated.

1,206,564. Fire-Alarm Apparatus; Peter McDonough, Braddock, Pa. App. filed Feb. 16, 1916. Installed in schoolhouses, hotels, dwelling houses, office buildings and other structures.

1,206,603. Electric-Furnace Control Apparatus; John A. Seede, Schenectady, N. Y. App. filed April 12, 1916. To move furnace electrodes in response to a variation of current.

1,206,617. Electric-Lamp Socket; George B. Thomas, Bridgeport, Conn. App. filed June 27, 1914. To contain lamps of large candle power.

1,206,634. Motor-Drive; James J. Wood, Fort Wayne, Ind. App. filed Sept. 2, 1915. For sewing machines and the like.

1,206,644. Fire-Alarm Apparatus; Orazio Alfredo Algeni, Providence, R. I. App. filed Nov. 27, 1915. Thermostatically-controlled circuit-closing device for sounding an electric bell or other annunciator.

1,206,652. Protective System; David Basch, Schenectady, N. Y. App. filed Sept. 7, 1912. For protecting stations on a transmission system.

1,206,662. Transformer of Continuous Current; Paul Marie Joachim Boucherot, Paris, France. App. filed Aug. 28, 1913. Effect the transformation of a direct current into another direct current of different pressure and volume.

1,206,677. Protective Apparatus; Elmer E. F. Creighton, Schenectady, N. Y. App. filed June 10, 1914. For the protection of high-tension systems of distribution and the apparatus connected thereto.

1,206,699. Relay; Charles E. Harthan, Lynn, Mass. App. filed May 19, 1915. Reverse current relay for use with an automobile starting system.

1,206,725. Alarm-Augmenting Means; Ray W. Orewiler, Portland, Ore. App. filed Oct. 2, 1914. Alarm mechanism of telephones.

1,206,731. Andrew L. Riker, Short Hills, N. J. App. filed Nov. 4, 1902. For igniting the combustible admitted to the engine cylinder.

1,206,734. Switch; William A. Spalding, Los Angeles, Cal. App. filed May 16, 1913. Locked in position.

1,206,737. Binding-Post; Louis Steinberger, Brooklyn, N. Y. App. filed July 18, 1913. For affecting a quick and substantially perfect contact with a conductor terminal.

1,206,738. Connecting Device for Electrical Conductors; Louis Steinberger, Brooklyn, N. Y. App. filed May 17, 1912. Formed of a suitable material such as "electrose" or hard rubber.

1,206,758. Trolley-Pole Controller for Electric Cars; Clarence V. Greenamyer, Los Angeles, Cal. App. filed March 6, 1916. By air pressure.

1,206,772. Alternating-Current Maximum-Demand Wattmeter; Clarence Alexander Boddie, Boston, Mass. App. filed March 30, 1912. New and useful improvements.